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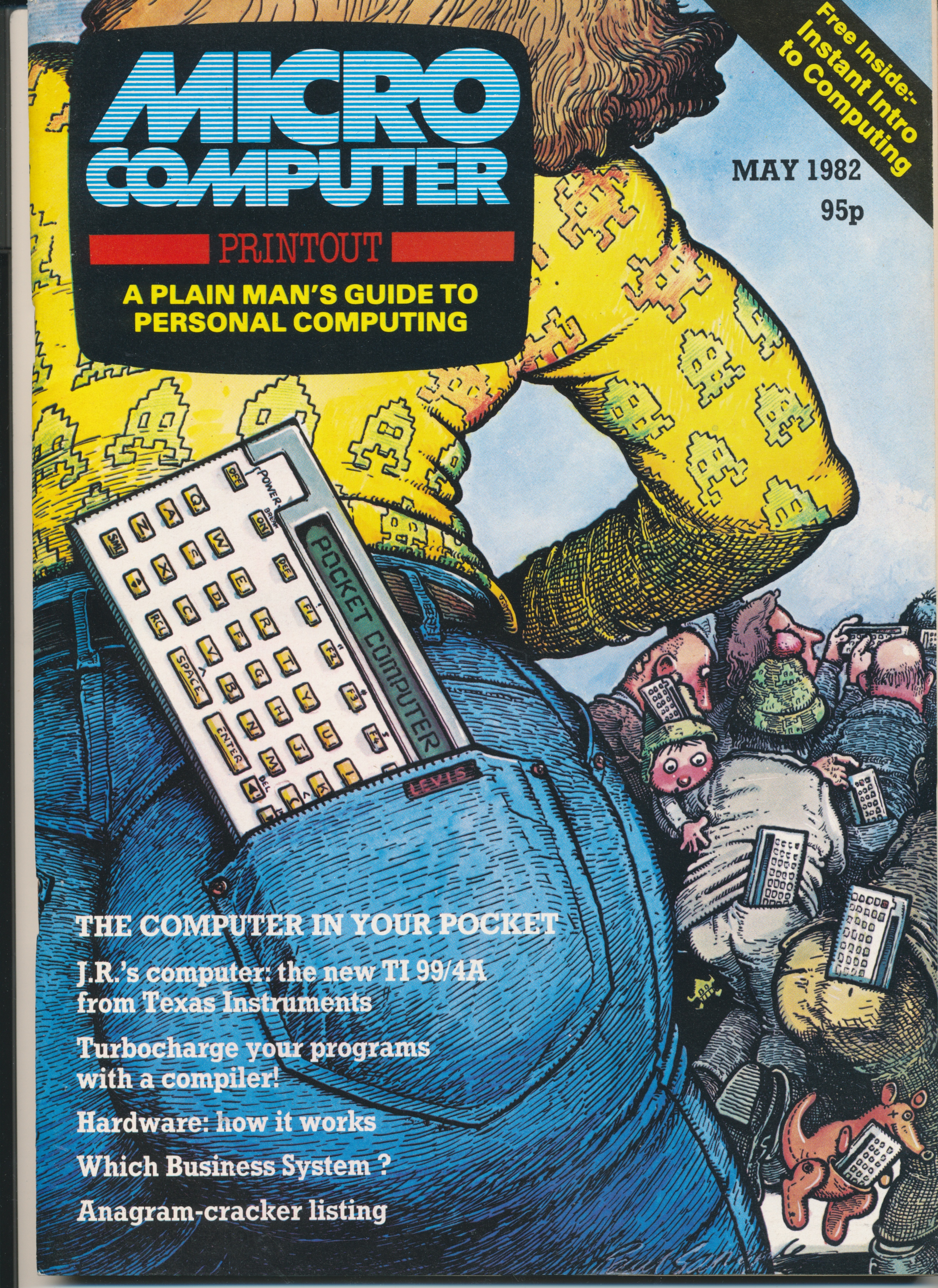
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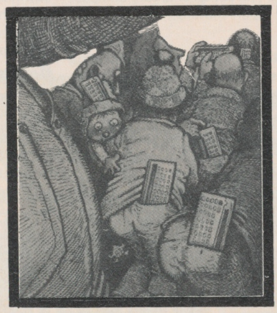
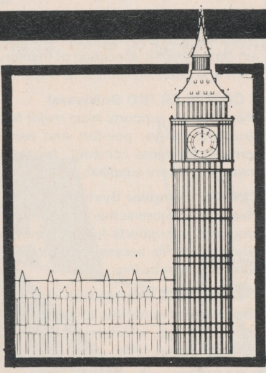
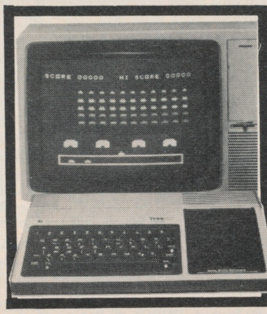




32 COMPUTERS IN POLITICS
Simon Hoggart takes a POKE at Westminster.

46 TEXAS
Computing's answer to 'Dallas' unveils an intriguing new computer.



58 TURBO CHARGE YOUR PROGRAMS
with BASIC compilers for PETS.

FEATURES

14 **HOW TO BUY A PURCHASE LEDGER** Choosing the right package.
22 **HOTLINE** The news from the *inside*.
42 **DEAR MR EDITOR** Sound advice for first-time buyers.
56 **PROGRAM DOCUMENTATION** How to get it right!
66 **THE ENERGY CRISIS SIMULATION** Complete listing for this fascinating educational game.
72 **WHICH BUSINESS SYSTEM?** Five typical computers compared.
82 **ZX81 UTILITIES** Eight useful programs that prove it ain't a toy.
18 **READ/WRITE** Where the readers fight back
36 **HARDWARE – HOW IT WORKS** Jargon free explanation for complete beginners.
52 **TRESPASSERS *WON'T* BE PROSECUTED** Computer fraud – the perfect crime.
62 **ANAGRAM CRACKER** Program listing to help you solve crosswords.
70 **TOMMY'S TIPS** Your programming problems solved here.
77 **DOCTORS – CAN COMPUTERS EASE THE STRAIN?** Micros in your doctor's surgery.
89 **REX MALIK'S OFFICIAL COMPUTER JOKE BOOK** The best and the worst.
98 **INSIDE TRADER** More 'off the record' info from our Gossip Columnist.

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PASCAL/M £220/£15
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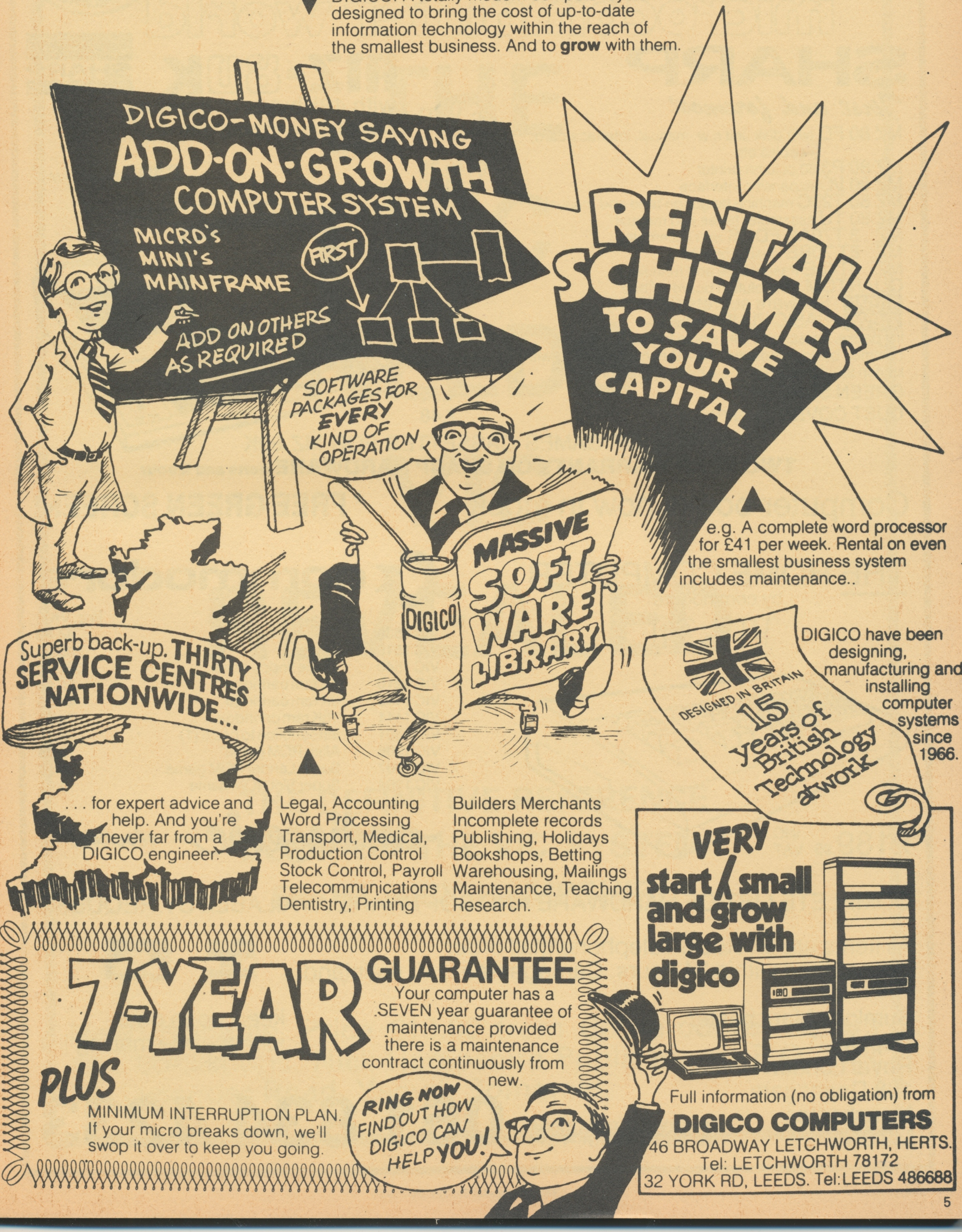
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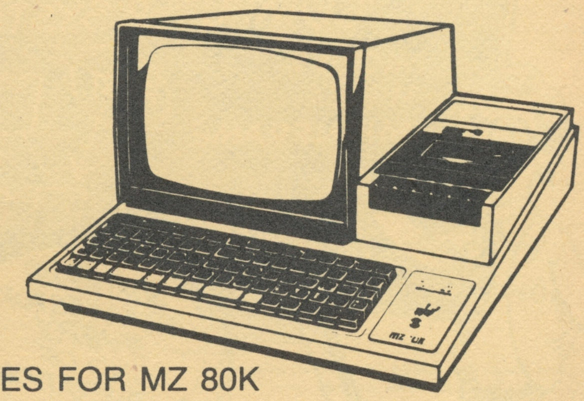

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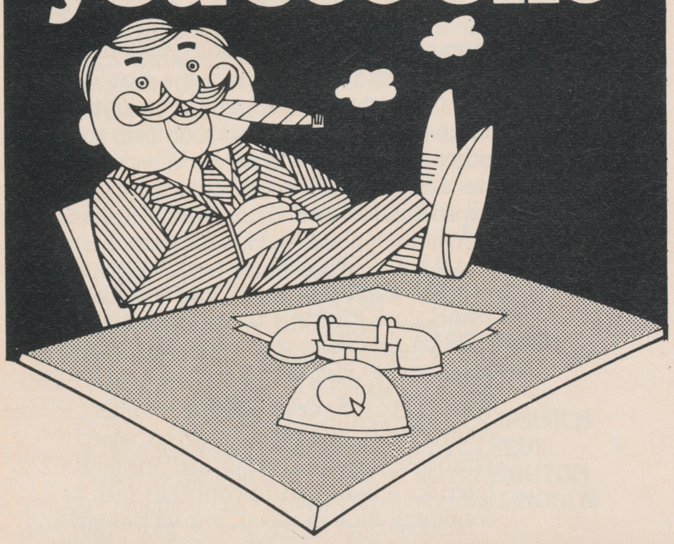

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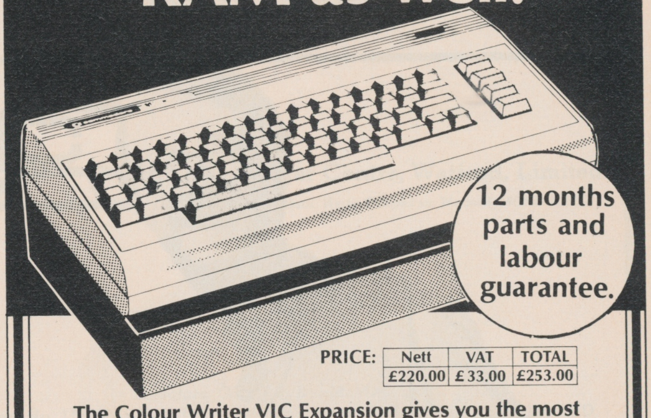
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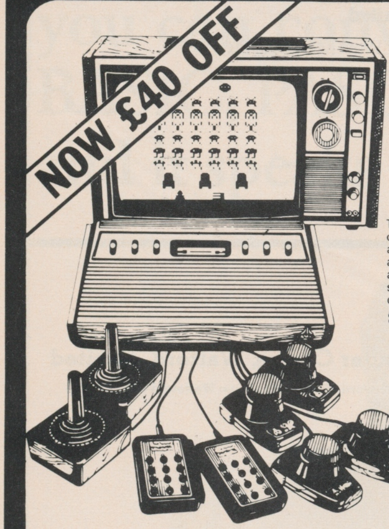

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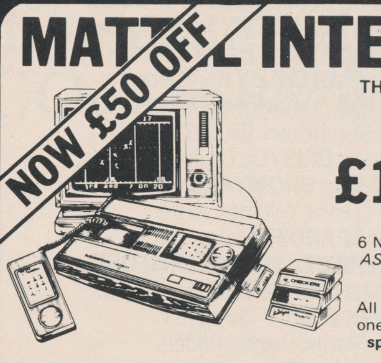

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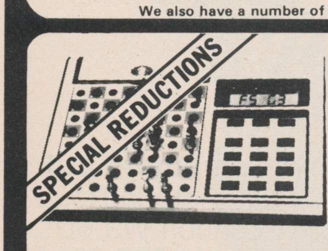

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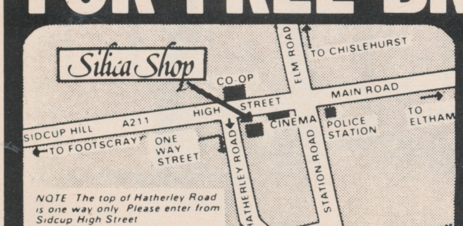

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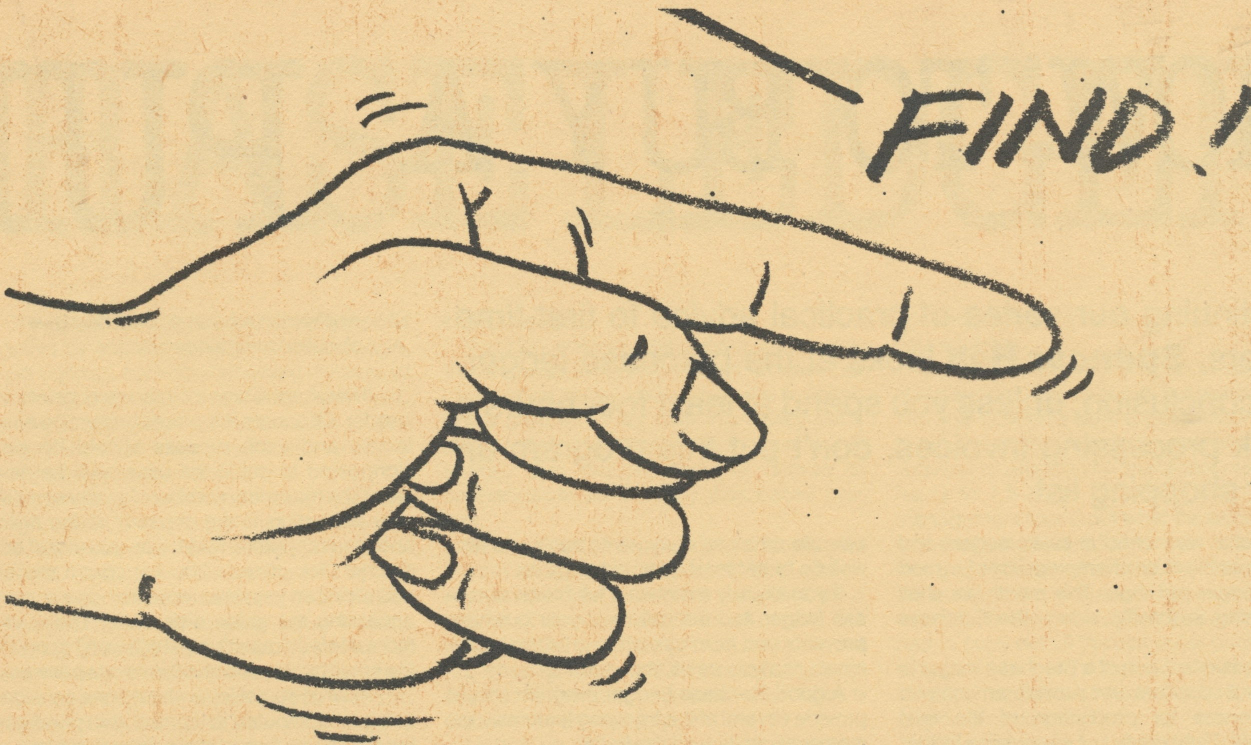

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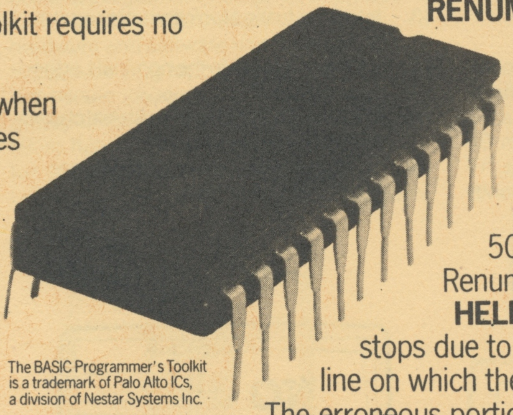
Please note that the Toolkit is not available directly from Zynar.

How Toolkit makes your programming easier:

FIND locates and displays the Basic program lines that contain a specified string, variable or keyword. If you were to type FIND A$, 100-500, your PET's screen would display all lines between line numbers 100 and 500 that contain A$.

RENUMBER renumbers the entire program currently in your PET. You can instantly change all line numbers and all references to those numbers. For instance, to start the line numbers with 500 instead of 100 just use Renumber 500.

HELP is used when your program stops due to an error. Type HELP, and the line on which the error occurs will be shown. The erroneous portion of the line will be indicated in reverse video on the screen.



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HOW TO BUY A PUR

Continuing our series of practical advice to first-time buyers, **Spencer Hall** looks at the purchase ledger. His conclusion: unless you spend at least four hours a week processing invoices, don't put this program on your shopping list.

Last month we looked at sales ledgers and discussed the main characteristics of a good sales ledger package. This month we shall be looking at the flip side – the Purchase Ledger.

The basic function of a purchase ledger is to control suppliers and provide an analysis of expenses for production of the final accounts. Tight control of a purchase ledger is not so important as a sales ledger as the onus of credit control is with the supplier and not with the customer. If you forget to pay someone then they will soon remind you – if you forget to invoice a customer, he may well 'forget' also!

Many small companies just keep a file of paid invoices and unpaid invoices, simply transferring the actual invoice from one file to another when it is paid after marking the invoice so that it isn't paid twice. This method saves the tedium of having to maintain a purchase ledger and so cuts down administration costs.

However, the limitations of this method become apparent when you start running into part deliveries or part payments of invoices, and control of unpaid invoices starts to deteriorate. It also makes the production of monthly accounts more time consuming as the unpaid invoices have to be analysed at the end of every accounting period.

Efficiency

So although small businesses may find computerisation of the sales ledger beneficial, the same gains in efficiency may not arise from the purchasing side of the operation. So don't go into a computer shop thinking "I'll have one of each please". If you currently operate on a cash payments basis you may well do better to let sleeping dogs lie.

If you already maintain a full blown purchase ledger and the nature of your business prevents you from operating on a cash payments analysis basis, then read on....

A good Purchase Ledger program should provide several of the following features – the more you can tick off the better.

1. A list of all suppliers in alphabetical order.
2. List of suppliers in account number order.
3. Produce remittance advices by selective criteria.
4. Display/print a suppliers current account position.
5. Maintain open item account details.
6. Write out cheques ready for signature (careful on this one).
7. Disallow single entry journals.
8. Permit discounts for quick payment to be identified.
9. Produce an analysis of all payments for posting to the Trial Balance.
10. Produce age analysis of all unpaid invoices.
11. Permit down payments to suppliers.
12. Display/Print control account at any time.
13. Interface to the stock control program (if required).
14. Interface across to the nominal Ledger (if required).
15. Print out day book entries for batch and month to date on request.
16. List suppliers together with turnover figures for year to date.
17. Ability to move some of the narrative about on remittance advices.

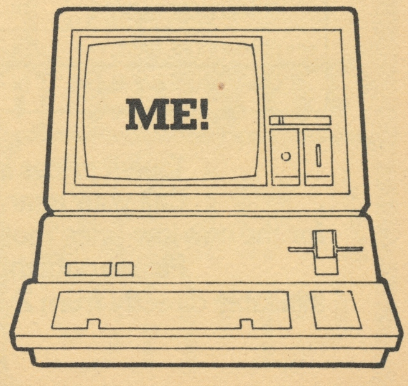
These are some of the main points to look for. Of course the program must be easy to use and each process should be well signposted to guide the user onto the next step. The maximum number of customers will vary according to the capacity of the disks and the computers' RAM. Can you install additional disk drives without program modifications? Can you have more than one screen accessing the same disk drive? These are more esoteric questions which won't concern the small business with 50 invoices per week.

At what sort of level should one consider using a computer to control the purchase ledger? If you spend more than about four to five hours a week just processing invoices and writing up the purchase day book and purchase ledger then you should look at the possibility of a purchase ledger program. Identify those areas which consume the most time. How useful would age analysis be if it was available to you?

Integrated costing

Of course, it may have occurred to you that the purchase ledger should be integrated into a costing system. This sounds like a really great idea in theory except that it gobbles up tons of disk space. It also means your production control and sales have to share the same database which leads to the problem of having the correct disk in the correct disk drive at the right time. Easy if you're a born juggler on an Apple disk drive. Guaranteed to lead to complete confusion if you're a normal fallible human being.

The only successful way in which you can thoroughly integrate a purchase ledger to a costing system to stock control to a sales ledger is – wait for it – Yes, you've guessed – a hard disk drive! That is why there are currently no fully integrated systems which can run on a microcomputer. That operation is still the exclusive preserve of the DEC's and Data Generals of this world.



RCHASE LEDGER

The possibility of fraud can be guarded against by implementing the usual management controls such as presenting invoices to the cheque signature at the end of payment, or only entering the invoice onto the ledger when the goods have been received or the services duly authorised.

The most common frauds on a purchase ledger are ficticious suppliers (controlled by periodic reviews of all suppliers with turnover figures), duplicate invoices (checked by day book listing and authorisation of invoices). Other means of combatting fraud include crossing cheques A/C payee only so that the bank will only accept the cheque in the name of the payee's bank account. Also examine returned cheques on the back for any signs of endorsements.

When entering details of suppliers' invoices you should be able to allocate the invoice to more than just purchases and VAT. You should be able to allocate the charge to a variety of accounts as well as identify any discount available for prompt payment.

Disk space

If the program offers open item accounting then cash payments will have to be allocated against specific invoices. Is this achieved relatively painlessly?

You may find it useful to be able to review a suppliers account for the whole year. Usually lack of disk space does not permit this luxury although it can be very useful to be able to examine the movements on a suppliers account over the period of a year.

If you already have a computer then you may find the printer is not suitable for some of the printouts which the program will generate. The age analysis in particular may be more than 80 columns wide which presents certain problems to standard 80 column printers.

Should your business require additional information such as the number of tonnes of fertiliser purchased or other quantity control totals then you will have to enter the realm of bespoke software or have a standard package amended.

You may wish to control back orders, i.e. those goods which have been ordered but have not yet been received from the supplier. Some programs may offer this facility but it starts eating into valuable disk capacity it is unlikely that you will find this degree of sophistication on a floppy disk based system.

So to sum up, a purchase ledger is designed to control suppliers and help a business make best use of its creditors as a source of finance. The onus of control lies more with the supplier than with the customer (for chasing up unpaid invoices) but you do need to know those invoices which offer a discount for prompt payment.

Unless you currently spend at least four hours a week processing invoices in one form or another there is little point in attempting to harness the micro chip to assist you. A micro computer system can only really offer the basic fundamentals of a purchase ledger. Due to lack of cheap permanent storage mediums (hard disks still have security problems) a fully integrated purchase ledger encompassing back orders, stock and production costing is at least two years away.

Cautionary tale

So much for Purchase Ledgers and their entourage. I would like to relate a story about the use of microcomputers in the rough, tough world of international business. The story concerns the tale of two British companies (who shall remain nameless to protect the guilty!) one of which has the ubiquitous PET, the other an £18,000 mini computer.

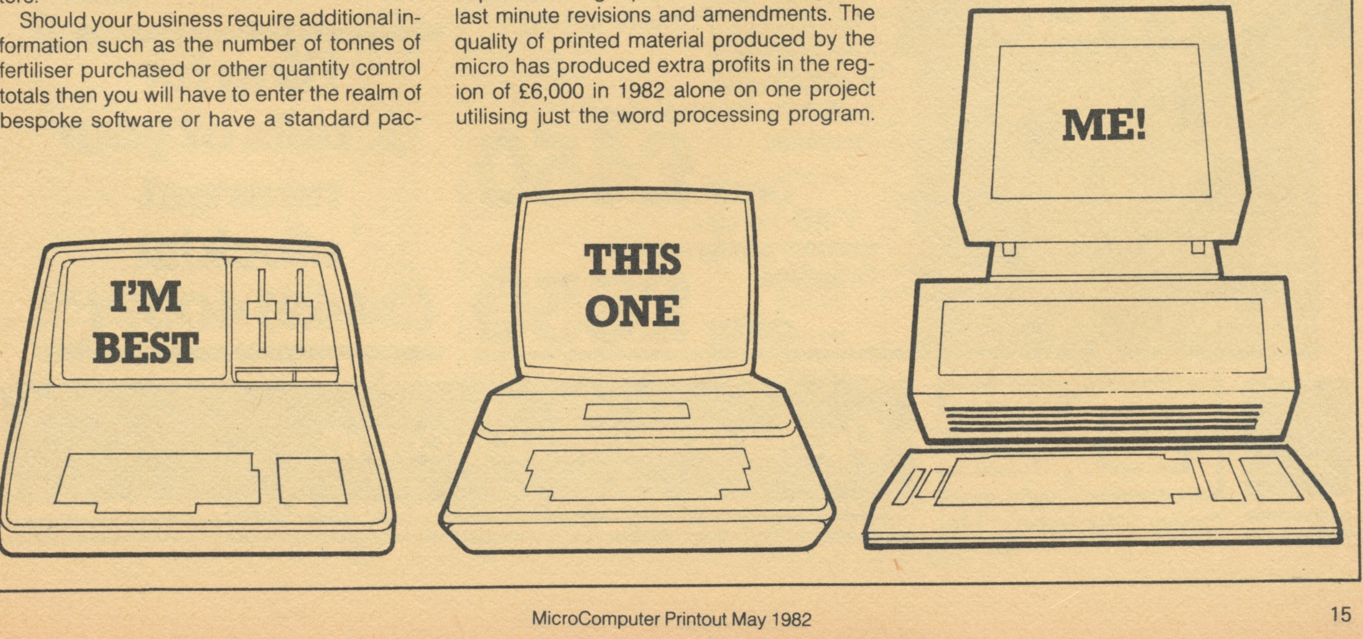
The company with the PET has a word processing program with a high quality printer. It has spent approximately £4,000 on hardware and software and frequently uses it to produce long reports which are subject to last minute revisions and amendments. The quality of printed material produced by the micro has produced extra profits in the region of £6,000 in 1982 alone on one project utilising just the word processing program. The machine is probably used for about 15 hours a week.

The other company has sales, purchase and payroll on the computer but nothing else. The final accounts were processed on a PET by an accountant in order to reduce the time required to process the final accounts from 8 hours to 1.5 hours. However, when senior management found out what the accountant had done, they were furious and forbade future use of the program and insisted that the accounts were prepared by conventional means. So the poor underpaid accountant had to copy out all the computer printouts in long hand, to fool the management that their request had been complied with. (I wonder why he is underpaid?)

One company is achieving a significant increase in its profitability and has taken on more employees. The other company has made a loss for the last 12 months and continues to do so. There are no prizes for guessing the correct answer.

See you next month.

Next month:
How to buy a Nominal/General Ledger



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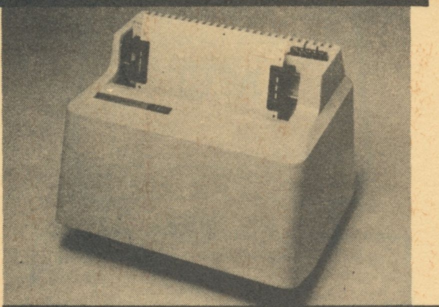

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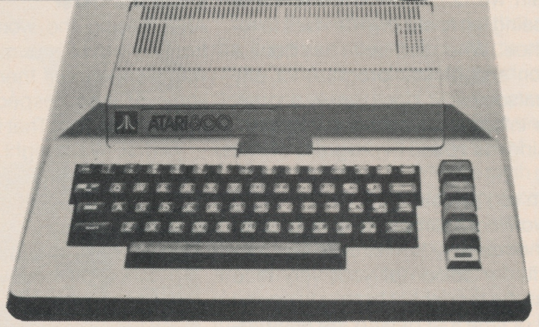

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READ/WRITE

Stimulating Simulation!

I have just been reading the March edition of *MicroComputer Printout* and I was very interested in the article by Humphrey Walwyn, which describes the setting up of games using the computer as a control.

Once again we come back to the same problem of being left to our own devices to re-invent the wheel. When someone has done a lot of work on a particular program for any purpose whatsoever, it does seem a great pity that the information cannot be shared, thus increasing the speed of progress of that interest.

Please can you ask Mr. Walwyn if he could provide a working example of this type of program either directly to me, or to be published in a future edition of your very nice magazine, as the thought of having to spend a great deal of time just getting the first prototype off the ground is enough to stop it being attempted at all. Even if Mr. Walwyn could describe the rules of one specific game it would probably be sufficient to get some of us started, and I personally would be prepared to pay for such information.

R.G. Hall,
Water End,
Hemel Hempstead, Herts

We're glad to oblige, Mr Hall, and at no additional cost (though all gratuities gratefully received – used notes only and mark the envelope Editor, *please!)*

In this case, Humphrey Walwyn has published the listing and program structure for a game called Energiesic – commissioned and designed especially for MicroComputer Printout.

Sufficient detail has been included both for you to expand this program, and develop your own simulations.

We hope your enjoy playing Energiesic – certainly it has proved addictive in the office, and with a bit of creativity on the board and playing pieces, it leaves behind most commercial games.

POKEing it in!

In your recent article on V.D. U advised us 'RAMs' to avoid "too much interfacing" and also .."loading our floppy dick units indiscriminately." Although highly graphic, the description of the transmission of this bug by a simple handshake, baud me.

Never-the-less I decided to play safe and made a resolution to date-a lady P.C. B'cose such women are less volatile and their high-level language is most educational.

I can imagine the pleasant evenings we shall spend:- a quiet byte in a candle lit restaurant, a night at the PROM's, and then back home on the bus for a bit of input/output.

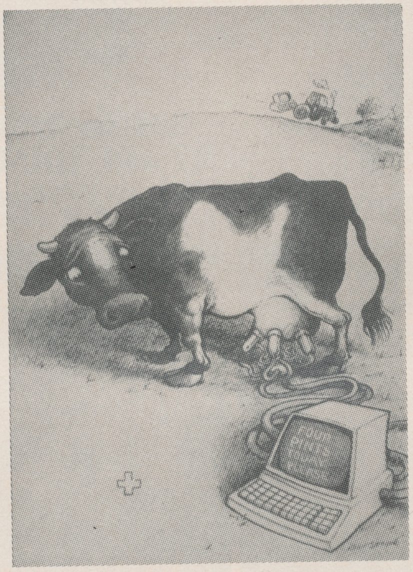
Mike Roesoft,
Romford

Suggest you refer to 'Interlude' program on Apple (reviewed MicroComputer Printout *– October '81) for immediate remedy.*

Sacred Cow

After seeing the wonderful artwork on the front covers of your magazine each month, I was wondering if there were any posters of some of them, especially the one with the cow (March 82). That face is wonderful.

A. Wainwright,
Sheffield



Alas no – though some of them would make rather good posters, wouldn't they? An exhibition of the work of Paul Sample, including the MicroComputer Printout *covers is shortly to tour the country, and we will advise dates and venues as they become available.*

Square-eyed

Please help! I've purchased a VIC 20, but because the cables that came with it are so short, I have to sit uncomfortably close to my TV set. Ideally, I would prefer to sit 10-15 ft away.

There are two variables between the TV and the VIC:

1. The video cable, connected to an RF modulator.
2. Another coaxial cable.

Which should I lengthen, and how?

Thanks for your help.

D. A. Pinless,
London SE14

p.s. Please make the answer as non-technical as possible!!

In view of the nature of this request we referred this one to our team of boffins who issued the following advice:

"It is essential that the characteristic line impedence is not over-attenuated as this would give rise to undamped image reflection and electromagnetic losses. High frequency decoupling capacitors between the braid shielding and modulated signal carrier will help, though if in doubt, balance the degaussing effect with an appropriate number of picofarads in the ground loop. Raster-scan signals are particular prone to bursts of negative phase demodulation so it is best to perform a fast fourier transformation analysis before finally disconnecting your high-persistence oscilloscope."

Clear? No?

Actually, it is a simple matter of extending the co-axial cable between the TV and the UHF modulator. Use a new bit of cable (from any TV shop) rather than joining two pieces together. The end which plugs into the modulator is an ordinary phono plug – which can be purchased as a HiFi accessory. If your soldering isn't too hot, then most HiFi shops would be happy to make up such a cable.

Milk Monitor

Dear Editor,

It is obvious that Inside Trader knows much less about the Apple III than he would like to have you believe. Here is some scoop which may earn you a free drink or two when the two of you next meet at a watering hole: to enter the Apple III monitor simultaneously depress the two keys which bear Apple legends and then turn on the power switch. The device will come up in the monitor with an arrow showing. Naturally the monitor syntax is different from the Apple II but the functions are the same (examine, modify, move memory etc).

Please have a chat with the proofreader for your front cover. A diary is a sort of notebook in which adolescent females tell lies to themselves and to their mothers. Surely the situation depicted on the front of your March issue is a 'dairy'?

Hal W. Hardenbergh,
President,
DTACK GROUNDED,
Santa Ana, California

The Gas Bill Story

In Mike's Muses (March *MicroComputer Printout*) he waxes lyrical about computer 'accuracy'. Here is a simpler 'error' to prove the point:

```
10 LET A = 10*192.6
20 LET B = INT(10*192.6)
30 PRINT A
40 PRINT B
50 PRINT A-B
```

Lines 30 and 40 *both* print 1926. Line 50 does *not* give 0. Try it and see. I have tried this on a ZX81 and a TRS-80.

192.6 has been chosen as it is one of the values which give an error; caused by the way computers hold floating point numbers and the method of extracting integers.

This 'error' was spotted due to a ZX81 per-

READ/WRITE

The Editor welcomes your letters, but if you require a personal reply please enclose an S.A.E.

son requesting help in a fairly simple program and being totally puzzled by the line 50 effect.

G. Bobler,
ZX-Guaranteed
Unsworth, Bury

How many of you ZX owners knew that one, then? Mike's Muse on computer accuracy was sobering to us all – and indeed, this sort of rounding problem is responsible for many of the apparently insoluble bugs which new programmers encounter.

Listings barred

Surely in the age of Information Technology and the microchip, there must be a better method of transferring listings via computer magazines? Consider the time and frustration taken in laboriously entering a program.

Would it be possible in the near future, as well as printing listings, to encode programs as a series of lines, similar to those used on grocery items? Then with suitable equipment one would just read the program into a computer using a light pen.

P. C. Whale,
Harlow, Essex

A very worthy idea, Mr. Whale – and one that is certainly feasible from a technical viewpoint. The idea has in fact been tried already in some American publications, and Hewlett Packard use such a system for loading programs from instruction manuals into their more advanced programmable calculators.

Two problems raise their ugly heads. First, for programs of the kind of length we publish in the magazine, several pages of Bar Codes would be necessary, because that is not a very compact method of representing characters.

Secondly – the hardware – someone has to produce a bar code reader at a sufficiently low price to persuade at least the majority of our readers to purchase one. And it must run on most microcomputers.

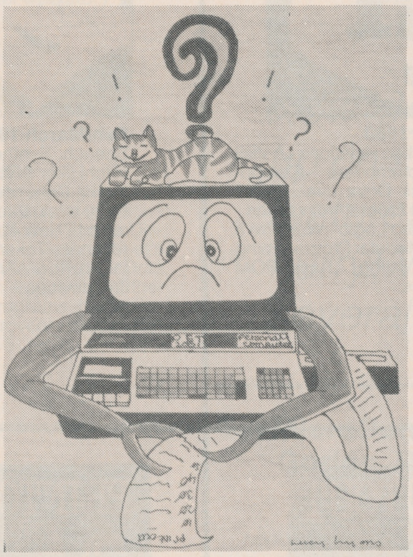
Nevertheless, it is a project we have considered for some time – and should the latter condition be fulfilled, we would be more than pleased to run a pilot scheme.

Program Verse

I just wanted you to see a picture of how I think a computer feels when we program it with all the computer garble one is supposed to program it with! I also thought you might like the little poem:

My PET

IF I SAVE much money
FOR my dog, I'll buy a NEW bone,
But IF he BYTES the OLD Postman again
He'll GOTO another HOME



FOR my PET is a nuisance,
Muddy PRINTS over my CLR HOME,
He POKES around in dustbins,
PEEKING up infections,
RUNning for elections,

What's the NEXT unexpectation?

Lucy Lyons (age 13)
London NW3

Hope springs eternal

I wish to announce that Terry Hope is alive and well and sitting in the centre of a hawthorn bush in Hampshire. This simple self-protection should prevent all but the most determined Atari hackers from beating his brains in after a nasty omission from last month's article "What Atari Didn't Tell You".

Unhappily, there was something Terry didn't tell you when he dealt with poking Atari's poly counters. Either that or, as he avers, it got missed at the printers. Personally, I think it's a shame to blame the printers. However, the two-line SOUND and POKE suggestion on page 45 should have contained a *second* direct SOUND command immediately after the first. Terry says if it's left out the result is dead silence and a fear that Atari is malfunctioning or that one has gone deaf. Inserted, all is well. The missing line was SOUND 0,100,8,8.

Now, if you'll excuse me, I have to go out to the bush with Terry's lunch.

Mrs Elizabeth Hope
Westering, Hampshire

CP/M denounced

Firstly may I thank you for a well informed and impartial magazine.

Having read your April issue with interest, I noted that several times you mentioned the "more popular CP/M".

I feel that I should point out that as none of the 'big three', being PET, Apple and Tandy, offer CP/M as a standard product, and together must represent well in excess of 50% of microcomputers sold, that it must, in fact be more popular not to use CP/M.

The popularity of CP/M is a myth generated by the media, who have more contact with manufacturers than they do with users. Admittedly more manufacturers use CP/M than any other operating system, but there are more computer users who do not use CP/M than those who do.

If an operating system is specifically designed for the machine on which it runs it is almost invariably going to be more efficient for that machine, than a "packaged" operating system.

However, the most important point, as mentioned in many of your articles, is the software. If the software is written properly and is suitable for the job intended, the user should not even be aware of the existence of an operating system, let alone be concerned with which one it is.

I would therefore be grateful if you would place less emphasis on the operating system in articles written for the end user.

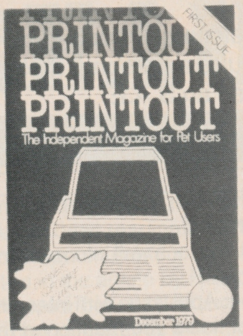
This is only of concern to software writers, and they already know the good and bad points of operating systems.

D.G. West,
Chess Consultancies Ltd.,
Cheetham Hill,
Manchester M8

Well stated, Mr West. We certainly agree that an operating system or application package written for one specific machine will be far more efficient and probably more user-friendly than a packaged one.

CP/M has in some ways become an excuse for new hardware manufacturers not providing software support for their machines. "It runs CP/M" they say "so it has access to a huge library of applications software." What they don't say is that many of the best business packages are written not for CP/M but for one specific machine such as the PET, Apple or Tandy.

In any event, we predict that CP/M will start to lose its hold with the arrival of newer operating systems. What is called for is greater compatibility between hardware manufacturers, not a blanket operating system that works on the lowest common denominator.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December 1979

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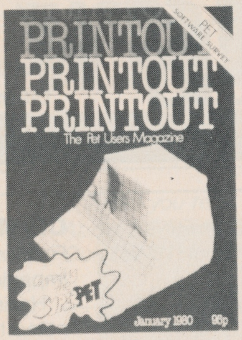
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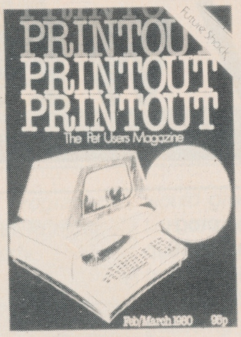
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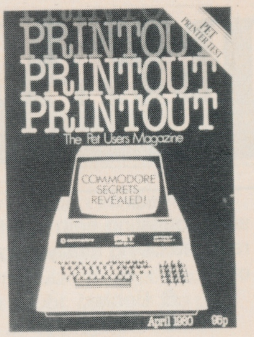
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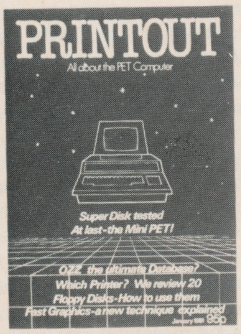
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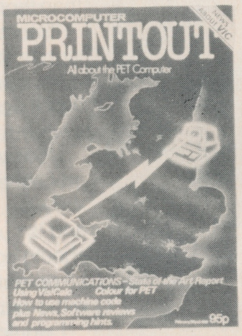
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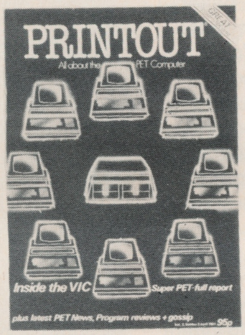
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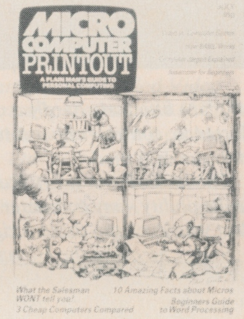

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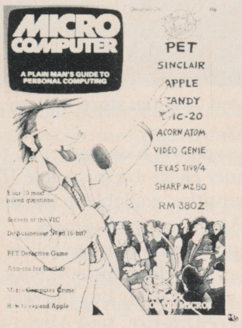

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ROBOTS

February 1982
How microcomputers are evolving into Robots – Consumer test on 8 popular micros – Should you wait for the new business micros from the Big Boys? – Are you in touch with aliens? – Converting BASIC programs – The microcomputer under business conditions – String Handling – Four programs for the ZX-81 – Great Computing Disasters – Custom Characters on VIC

MICRO COMPUTER
THE ENERGY CRISIS SIMULATION

April 1982
Energy crisis simulation – Computers in the movies – Artificial Intelligence – How to buy a Sales Ledger – Solicitors - Application special – Hi-res graphics for VIC – Spelling Corrector Programs – Five business micros evaluated – More secrets from Atari – Which programming language is for you? – Adventure on Atari and ZX-81 – Does the Sirius 1 obsolete all other micros? – Decision Maker program listing.

Telex via Computer

'The Medium is the Message', as Marshall MacLuhan remarked in his incomprehensible 1964 opus *'Understanding Media'*. But last week this questionable thesis was vindicated – as our production manager, Wendy, struggled to restore a news story into something resembling English.

The article – on communications needless to say – had been telexed to our office, retyped and then keyed afresh into the typesetting machine. The result, as you would expect, was gibberish.

Wouldn't it be nice, we thought, not for the first time, if the whole thing could be automated. And now, fellow sufferers, it can. For Encotel Systems have developed the necessary software to automate the sending of telex messages by microcomputer.

Here's how it works. The computer is linked via an RS232 port to the telex interface unit which is connected directly to the ordinary telex network. Once the software has been loaded, messages can be sent and received *in the background,* while you carry on with your normal computing tasks.

Encotel have the telex system up and running on the Intertec Superbrain, but will shortly have versions for other CP/M machines. British Telecom have tested it and given full BT approval.

The interesting thing from our point of view is that standard CP/M text files, such as those created by word processing software, can now be sent as telex messages.

Telex messages are of course all in capitals, but the system carries out the necessary ASCII to Baudot data conversions, compensating where necessary for lower case letters. Further details can be had from Bob Jones at Encotel Systems, 530-538 Purley Way, Croydon, Surrey.

Getting stories back from our foreign correspondents in time for copydate has provided more than a few headaches in the past, as the Editor's depleted stock of Aspro's bears witness. This month former *Times* correspondent Michael Frenchman, will be taking delivery of the Osborne 1 briefcase computer he bought after reviewing it in The Thunderer. He plans to transmit copy for future articles to us via the international telephone network using an acoustic coupler and the *Microlink* program.

Perhaps the first British journalist to file stories in this way was another of our contributors, Guy Kewney, who managed to scoop competing trade weeklies with a report from this year's Consumer Electronics Show in Las Vegas. He too used the Osborne 1 because of its portability. Details on how you can communicate from Osborne Computers at 38 Tanners Drive, Blakelands North, Milton Keynes.

GOTO JAIL

Go To Jail – Do Not Pass Go – Do Not Collect £200. Yes, it is *Monopoly*, the classic property speculation game in which Whitehall and Park Lane change hands for £375 a piece and you can pick up a railway station for just £200.

Derek Tidman of Work Force has adapted it to run on Sinclair ZX-81s equipped with 16K of RAM.

Up to six players can compete, with the computer acting as board, rule-book, umpire, dice thrower, accountant and rent collector. The player is guided through the game by a menu indicating whose turn it is and what property and cash they hold.

The game is played using such commands as BUY, SELL, MORTGAGE, BUILD and so on. As Monopoly games frequently turn into marathons, Derek has sensibly included a routine to SAVE the current game on tape.

ZX81 Monopoly costs £8 from him at 140 Wilsden Avenue, Luton. Somewhat cheaper than the original!

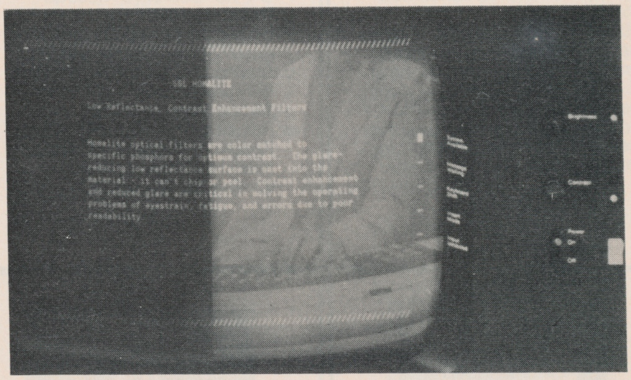
Now if this darn computer would just throw me a double I could get out of JAIL and rejoin the game....

Curse of the Hotline

Selwyn Ward is a man who never touches wood, and breaks mirrors without a second thought. He must be, because he has just asked me to publicise his new journal *Computer Games Review*.

Starting with the June issue the £10 a year bi-monthly will concentrate on reviews of games programs. Ward's address is 10 Star Lane, St. Mary Cray, Kent.

Bearing in mind the kami-kaze style record of organs previously publicised on this page, I give it three months. At the outside. Touch wood.



Anti-glare filters are hardly a new idea, but the Homalite *low reflectance, contrast enhancement screens must be the Rolls Royce of filters.*

The idea of course is to cut down eyestrain and fatigue, or in my case illegibility – my computer screen being cunningly positioned to reflect whatever sun there is right into my eyes.

SGL who make the Homalite filter will actually sell you one that is colour matched to the phosphor of your screen. The bad news is that they are at 76 Euclid Avenue, Hadonfield, New Jersey 08033, once uncharitably described as the armpit of the USA.

Apple Trainers

Everyone has their favourite software horror story. Mine concerns the man who bought a Payroll package that worked perfectly, but for one thing: it used American tax codes and required all salaries to be in dollars!

Apple have had a truly original idea that could make such disappointments a thing of the past. Called *Trainer Packs*, they contain the kernal of such programs as *VisiCalc III* and *Applewriter III*. For £18 you get the documentation and a diskette which allows you to do a sample run of the real program in the privacy of your own home. All in all, a considerable improvement on the usual five-minute high pressure demo you might be treated to in the store – if you are lucky.

As you will have gathered, the Trainer packs are for Apple III. Other titles available in the series are *Mail List* and *Business Graphics*, with more to follow.

Can you claim the cost back if you subsequently buy the real thing? "Um-Err" said Apple when I enquired. So it can't do any harm to ask.

Talking of Apple software, the company are about to publish a useful directory. I counted 17 'approved' programs for Apple III. The latest of these include a communications package called Access III, the *Script III* text editor for Pascal text, and a *Pascal Utilities Library*. The directory is free.

by Julian Allason

Shoot the Messenger

I have bad news for the promoters of the forthcoming *Computer Controlled Video Workshop.* The video disk is about to be pronounced Dead On Arrival.

Which is a pity, since video disks, with their ability to store hundreds of thousands of frames of information on a single low-cost platter, offer a far more cost-effective means of storing data than yer actual Winchester – let alone floppy – disks.

It is fully seven years since the first video disk player was announced, and RCA, Philips and sundry Japanese megaliths have been selling them in the States since 1977. Without, it must be admitted, a great deal of success.

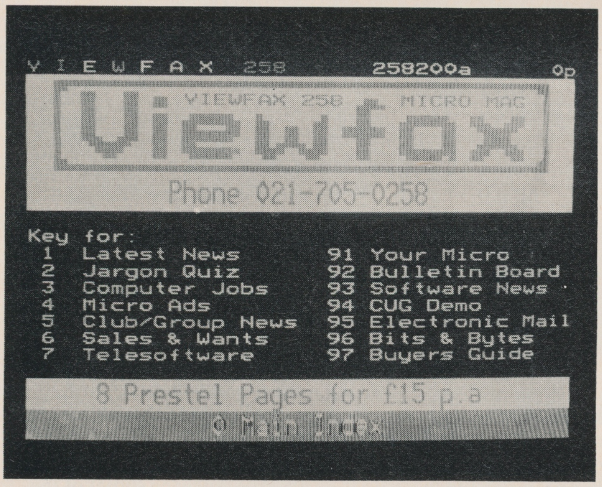
In fact it was the video disk manufacturers who first learned to appreciate that it is software that sells hardware, a lesson lately re-discovered by micro-men.

The fact that video disks can't *record* didn't help much, either.

The final nail in the video disk coffin is the agreement of a single standard for low-cost miniature video tape cassettes, upon which the signatures of Sony, Philips, and the other big video names is barely dry.

Friends in low places tell me that this has already led to money earmarked for the development of the video disk being diverted to said low-cost miniature video cassette recorder projects. Without the economies of scale offered by a consumer mass market the video disk looks as if it will become a rather more expensive piece of kit than it is at present.

All this has happened so recently that the brake has yet to be applied to the development of computer interfaces to video disks. Indeed, an enterprising American company is already offering a video disk storage device linked to an Apple. Delegates to the *Computer Controlled Video Workshops* (admission £275!) will be able to play with it on May 18th and 19th and June 17th and 18th. Details from 108 Kew Road, Richmond, Surrey.



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       Viewfax
   Phone 021-705-0258
Key for:
 1  Latest News       91 Your Micro
 2  Jargon Quiz       92 Bulletin Board
 3  Computer Jobs     93 Software News
 4  Micro Ads         94 CUG Demo
 5  Club/Group News   95 Electronic Mail
 6  Sales & Wants     96 Bits & Bytes
 7  Telesoftware      97 Buyers Guide
   8 Prestel Pages for £15 p.a
        0 Main Index
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I think I had better tell you about these people, because single handedly they have convinced me to do something that a mega pound advertising campaign from British Telecom failed to do – and that's to become a Prestel subscriber.

Folks in question are Messrs. Reid and Henry who run a free daily electronic magazine all about micros, called Viewfax 258. Apart from news, there is also free software to download. It is accessible to 15,000 odd subscribers to Prestel.

Obviously the money has to come from somewhere, and Viewfax raise it by selling pages at £15 a time to computer manufacturers and dealers to run their own newsletters, bulletin boards, product directories and dealer lists.

One major advantage Viewfax enjoys over other bulletin boards is that it is available 24 hours a day at local call rates. Prestel information is also sent at four times the speed of most bulletin board systems.

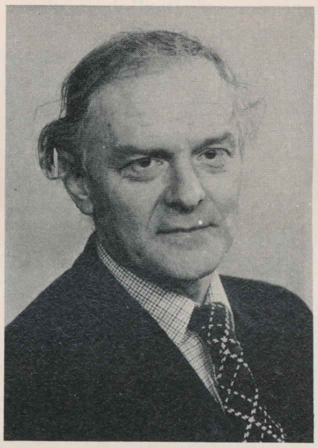
The magazine has allocated a number of pages to computer clubs which they can edit themselves free of charge. Response frames are provided for electronic mail and the ordering of products and services. Micro owners are also offered free space in a 'Sales & Wants' section.

You can reach Viewfax 258 by telephoning 021-705 0258 or use Prestel mailbox 021704115 if you are already on the system.

The squeeze is on

My problem with floppy disk systems is that I can never get enough on them. Though different types of floppy disk vary in capacity by a factor of up to 10, sooner or later one finds oneself swopping disks around like playing cards for lack of space.

Which is why computer scientists all over the world have been researching into *Data Compression* – ways of squeezing more information into the same number of bytes. The problem to date has been that the best methods offer an improvement of only about 20%, and are very slow both at encoding the data into its compressed form and subsequently decoding it again.



Enter Dr. Dennis Andrews; he's a sort of cross between neurobiologist and engineer (in case the photograph hasn't already given that away) from the University of Keele. He's come up with a program called E40 which claims to reduce text files down to about 40% of their original size – and in not much more time than it takes to make a copy of the file!

Maddeningly he won't tell me how it's done. Even my best set of trick questions (guaranteed to extract a full confession from the most tight-lipped company spokesman) reveal only that E40 is based on 'statistical properties of English'. "Even the University's computing department don't believe it's possible", chortles the good doctor.

The utility requires no knowledge of what is in the file to compress it, since it can cope with all 256 possible ASCII character codes – including the special symbols used for embedded controls in word processing.

Though primarily designed for normal English prose, E40 apparently copes with Olde English Poetry, technical manuals and even straight numerical data. We have yet to try it out on Tommy's 'English'

E40 was developed with mainframes, minis and micros in mind, and in the latter case is now available for any machine that will run CP/M. A 6502 version is apparently 'nearly finished', aimed at the Apple II, III and (ultimately) PET.

E40 works as a utility in RAM (occupying around 9K) and you simply compress or expand any file on the disk. This rules out random access files – where you only use part of a file at once. Andrews hopes that several word processing suppliers will link their products to E40 – thereby making the whole process transparent to the user.

E40 is available for £100 + VAT (inc. P&P) according to the good doctor, or £99.95 + VAT if you believe his marketing advisors. You can get it from Keele Codes Ltd., University of Keele, Keele, Staffs. ST5 5BG.

Angry Letter

'Angry of East Grinstead' has taken me to task for writing about the Olivetti mini-Winchester disk last month. It works with neither his PET, Apple nor, he says, any other proprietary system.

Stand easy, 'Angry'; I have the answer. The boffins at Small Systems Engineering are even now putting the finishing touches on a mini-Winchester disk system that will plug directly into your PET, giving up to 12 megabytes of hard disk storage under either the PET Disk Operating System, or CP/M. Or both!

What's more, under CP/M, this new MW1000 system will run *without* the PET if any standard terminal is plugged into the built-in RS232 serial port. This, as the Small Boffin is not slow to point out, amounts to a very economical, stand-alone Z-80 based CP/M computer with 60K of RAM and a hard disk.

£3360 is the cost of the 12 megabyte system, although there is a 3Mb version for a more modest £2538 + VAT. The Small Systems boffins reside at 2-4 Canfield Place, London N.W.6. Tel: 01-328 7145.

►

New generation of PETs, VICs coming

EXCLUSIVE: Commodore are about to announce not one but *five* completely new computers.

They range from an intriguing sub £100 computer/music synthesiser/video game machine, to a powerful new business computer with 256K of RAM.

Commodore plan to unveil the new range – which will eventually kill off the PET – at the Hanover Trade Fair in late April.

Here is a model by model breakdown with the (hitherto) confidential details of each machine:

THE ULTIMAX is a low-cost combined computer, sound synthesiser and colour video game machine. Like the current VIC-20, it normally plugs into a TV screen, but for special high resolution effects it can be used with a colour monitor.

The *Ultimax* accepts plug-in cartridges, but *not* the same ones as the VIC-20. A variety of video game cartridges will be available, as will a sound synthesiser with 'piano' overlay for the membrane keyboard.

To compute, a BASIC cartridge must be slotted in. This is not the 'standard' PET/VIC/Microsoft BASIC, but a subset of it minus trig. functions and dimensioned arrays.

Did I tell you that the colour graphics are superb? Well they are, with up to 16 different colours on screen at any one time, and high resolution of 320 x 200 pixels (picture elements or points) built-in.

The designers have also adapted the 'sprite' graphics techniques developed at MIT for the Logo language. A sprite is a single character that you create on a 24 x 21 matrix, which can then be moved around the screen independently of anything else. It might be a Space Invader, a transistor or whatever you choose.

In fact, you can have up to 256 such sprites and in a variety of colours. They can pass over or under each other on the screen, or simply collide. Up to eight sprites may be on any one line, so large 3D effects can be created. Because screen images can be moved pixel by pixel, both horizontal and vertical scrolling is possible.

Whereas on the VIC-20 both audio and video output are controlled by the VIC chip, on the *Ultimax* the VIC chip has been split into a 6566 chip to handle the more complex video display, and a 6581 SID sound synthesiser. A variety of sounds can be generated, making it possible to simulate different instruments in eight voices.

The CPU is a 6510, essentially an upgrade of the PET's trusty 6502 chip. It uses the same machine codes but has an additional 8-bit output port that is bit-by-bit programmable. This allows more memory to be accessed than on the 6502, but without recourse to memory management routines.

The *Ultimax* uses the standard Commodore cassette system for storage, and comes with 1K of screen RAM, 1K of colour RAM and 1K of user memory. The BASIC cartridge includes an additional 2.5K of RAM.

Probable price: £99 inc. VAT, but with CBM marketeer John Baxter covetously eyeing the lucrative Sinclair market, he might persuade Big Bob Gleadow to let him sell it for less.

Target date for release is September, but you know about Commodore and their release dates ....

Much heralded the **VIC-40** leaves most prognosticators with egg on face. Contrary to prediction it has more in common with the *Ultimax* than the current VIC-20 model. It will, for example, accept *Ultimax* cartridges, but not VIC-20 ones – a further example of lack of long range planning at CBM.

It looks as if there will be two models, one priced at about £300 with 16K of RAM, and a 64K version at around the £500 mark. The latter will, as with the PET, have 32K of RAM accessible by the user from BASIC. The remainder up to 52K will be available for languages etc.

The VIC-40 will share the same ROMs as the existing VIC-20, so there shouldn't be any compatibility problems there. In fact it will be possible to redefine the memory map, so conversion and tailoring of PET and VIC software should be straight forward.

It will be possible to plug more accessories in without the need for multiplexer: four games paddles, two joysticks or two light pens.

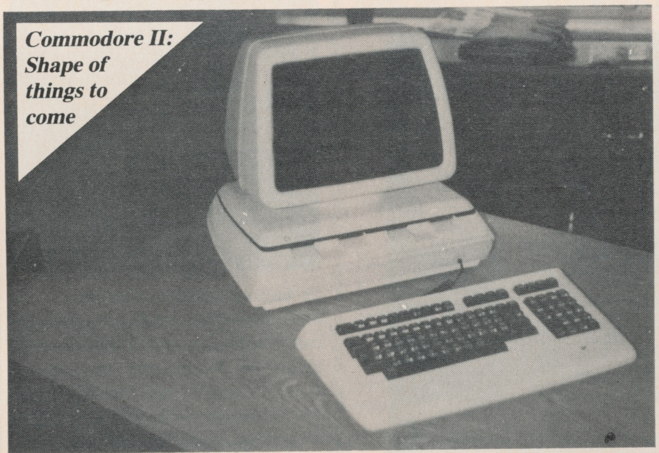
Case and keyboard will be the same as the VIC-20.

According to the Commodore leaks department, there are also plans for a direct connect modem, Z-80 softcard, Extended BASIC ROM and Extended Machine Code cartridges, the latter necessitated by the lack of a built-in machine code monitor.

Release date is currently scheduled for the end of the year.

The **Commodore 64** looks like a replacement for the 4000 series PETs, from where we stand. However, Commodore are likely to continue making the latter for as long as there is a demand.

Smart new ergonomic styling resembles a rounded off PET, with detachable keyboard and tilt-and-swivel screen. The new keyboard seemed a considerable improvement when I tried it, both from the point of view of 'feel', and the provision of ten programmable function keys.



Commodore II: Shape of things to come

Commodore's marketing bods reckon the *CBM 64* will slot in just about the VIC-40. Screen layout is still only 40 columns however, but BASIC 4 will be implemented, so all that 4000 series software should run without difficulty.

The **Commodore II** is where it all starts to get interesting. Two models are planned, with 128K and 256K of RAM memory respectively. Some sources hold they will be marketed as the *CBM 128* and *CBM 256*.

Whatever the designation, both will have the same space-age styling as the *Commodore 64*, much of the design work on which was performed by Porsche before Commodore fell out with them. Disk drives will be built into the base. These will run off DMA so they should be very fast.

The CPU is a 6509 (no blood relation of the 6809) with bank switching between the 16K RAM banks. Screen format is 80 columns by 25 lines with a built-in high resolution graphics capability (but will it be implemented?) There is also a 24 hour clock with programmable alarm, so no doubt someone will offer a battery back up to keep it going when the power is off.

Commodore have at last provided both RS232 and IEEE-488 interfaces onboard. Judging by the preliminary spec, wot I have had sight of, it looks like the full, debugged IEEE-488 – at long last!

Taking the 256K version, 64K of memory will be allocated to the operating system, probably to allow space for additional processors. It is likely there will be slots for Z-80, 6809 and 8080 processors. Hints of a revolutionary new 'universal' computer capable of running "any" software have been dropped by Commodore bigwigs recently. Despite enthusiastic reporting in the national press, we remain unconvinced; the Z-80 softbox for the PET is hardly a new item, and the CBM micro mainframe already offers dual processors.

Returning, reluctantly, to the *CBM 256* memory map, we find 128K available for softloaded languages and operating systems (such as CP/M?), and additional space for expansion ROMs.

It is also worth noting that the memory will be capable of expansion to 512K with an external box.

On the software side we find that the language subset of the 6509 is almost identical to the well-tried 6502, so although there is no direct compatibility with software for the 8000 series PETs (aaghh!), conversion "will be easy". Their words, not mind.

Rather sensibly Commodore have chosen to get their 'Approved Products' suppliers involved before, rather than after, the launch of the new machine. At a confidential briefing session, into which I managed to insinuate myself, one of the software publishers asked the obvious question: 'With all this RAM space and memory mapping, will character sets be definable?' Answer: 'That's why we invited you here today'.... Proving beyond doubt that the Commodore still believes that Software sells

by Julian Allason

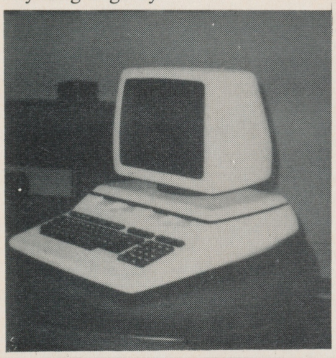
Hardware. It is on the basis of this broad base of supporting software that the new range of computers will be marketed.

One final observation on the *CBM 128* and *256*: there appears to be 5 levels of interrupt, so the designers may well have mutlitasking in mind. The implementation will probably be left to an independent software house, if past experience is anything to go by.

Oh, and there is also the kernal of a network built-in. No doubt the same will apply to the commercial development of that also.

Price? Probably £2000+ for the 128K model; £2500+ for the 256K versions. Availability from around late summer time.

Of course there are still persistent rumours of a 16-bit machine from Commodore – but that's another story.



Soap Opera

It has become a tradition on this page that there should always be a column entitled 'What *Is* Going On At Atari?

It being business as unusual at Atari, I will endeavour to bring you up to date. Last month's episode saw Atari signing over a (reportedly) six figure sum to their ertswhile UK agents, Ingersoll, for the right to distribute their own products here.

This episode finds ace Atari marketeer Pip Errington, poised to defect to Commodore, her head turned by the blandishments of Range Rover-driving Big Bob Gleadow.

Mystery surrounds the whereabouts of erstwhile general manager Steve Bernard and his amazing leather trousers.

And what is to become of Ingersoll's contracts with software authors? (not a lot, according to virile pipe-smoking Ian Lawrie of *Silicon Chip* who says he will paddle his own canoe).

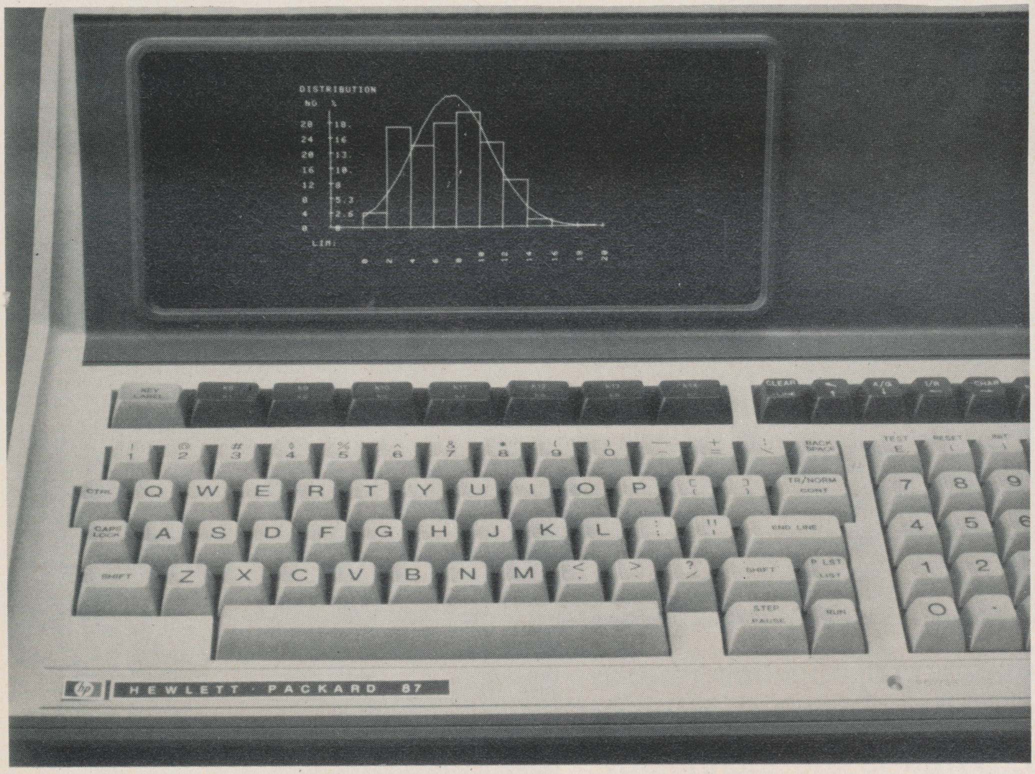
Confused? You won't be after the next episode of *Soap*.

Serious Software

With ACT signing up new dealers for their 16-bit Sirius 1 at a rate of more than one a day, there has been quite a race to get commercial software up on the system.

First past the post has been Zenithplan with a Sirius version of the Compact accounting suite, comprising Order Processing and Invoicing (£700), Sales, Purchase and Nominal Ledgers, Inventory and Payroll at £350 each. All are said to be capable of integration.

ACT who have their own integrated accounting suite called *Pulsar* due for imminent release, were putting a brave face on it. "We are pleased to see Sirius supported" said a spokesman through gritted teeth.



New HP-87 personal computer from Hewlett-Packard features high-resolution, built-in 80-column display for text and graphics, and seven special function keys which (with shift) make available 14 user-defined functions.

Hewlett-Packard enjoy what almost amounts to a cult following amongst the engineering fraternity. When their HP-85 personal computer was unveiled two years ago I hardly knew whether to be more impressed by the business-like design or the prices. And if you don't encounter many HP-85s outside engineering offices, those prices are the reason.

Now Hewlett-Packard are launching a new computer, the HP-87 which disposes of most of the other points of criticism, notably that of an overly small screen.

The new machine has high resolution (544 x 240)‸80 column text and graphics display plus the ability to add substantially more memory – up to 544 kilobytes. That may sound like a lot, but it equates to a VisiCalc worksheet of 254 by 63 completely full cells, and problems as complex as that, though on the large side, are far from unknown.

The standard HP-87 is being supplied with 32K bytes of RAM at £1650 + VAT.

HP offer their own range of software covering scientific and engineering, and some business applications. Belatedly they have introduced a plug-in CP/M module which will give users access to a much broader range of software, including programs written in Pascal, FORTRAN and COBOL languages. However, the CP/M system, which incorporates a Z-80 program, costs a not insubstantial £972.

The HP-87 is described as 'upwards compatible' with the '85, which means that programs for the earlier machine will run on the new one.

HP offer their own line of peripherals including, as you would expect, single and dual floppy disks, and for larger, richer customers, a 5 megabyte fixed Winchester disk with 270K built-in mini floppy. There is also a new "low-cost" graphics plotter costing £969.

HP have their own Literature Enquiry Section at King Street, Winnersh, Wokingham, Berks, who will be happy to swamp you with brochures.

THE COMPUTER IN YOUR POCKET

POWER
OFF
ON
BREAK
DEL
F1
F2
F3
F4
SML
SPACE
ENTER
RCL
POCKET COMPUTER
LEVI'S

Are the new generation of pocket/portable computers genuinely useful – or merely executive toys? What is the technology which makes these 'wonder boxes' possible, and what developments are likely in the next few months? **John Gowans** reports the State-of-the-Art.

POCKET COMPUTERS

...The strangely-shaped Earth creature twitched, his eldritch non-complex eyes desperately searching for an RS232C interface to his ship's host computer. With a nonchalant upside-down smile, Zog the Alien tapped keys on the box in his hand and read the answer he expected; with reptilian grace he drew his disintegrator... (© A. Morgan 1980, from the creator of 'Zog Goes to the Laundrette' and the current top seller, 'Zog and His Vet have an Identity Crisis.')

In one powerful paragraph, a sadly-neglected science fiction writer sums up the benefits of pocket computers; you can figure out whether Earthlings are hostile without plugging into outside power, either electrical or computational. No alien should be without one.

And if the industry pundits are to be believed, earth creatures too will soon feel underequipped without their portable micro. Listen to Egil Juliusson, of Dallas prediction firm Future Computing, as he projects sales figures of $750m for the pocket computer market by 1985. And Egil goes on to say that this represents 2,500,000 over-the-counter sales – figures comparable with the numbers floated for sales of personal computers in general (conventional ones, that is) by that time.

Wrist-watch calculator

It should be clear that we are not talking about your common or garden pocket calculator here, let alone the appalling wrist-watch calculator that has to be poked in the keys with a sharp stick. Egil would not have kept his futurist's job long if he had started 1982 by predicting big sales for these elderly devices.

No, what we have here are real microcomputers on an even smaller scale than usual, full-feature pocket machines with their own long-life power sources, displays, tiny peripherals, and high-level programming languages. Little computers that can run the same kind of programs now running on the micros in today's offices and homes, only they can do it in tomorrow's airliners, tilting trains, or public conveniences.

The big marketing push in the new area is now on, trying to convince cable-bound computer users that they have nothing to lose but their interfaces. On the back cover of a recent *Byte*, science and science fiction writer Isaac Asimov – looking even more Dickensian than usual in his enormous Rhodes Boyson side-whiskers – holds up a Radio Shack pocket computer to the reader's gaze. Gives the machine that futuristic air, see? And more of the same is on the way as the Japanese firms gear up their formidable production lines to the new boom, and the Western computer firms wonder what to do with it.

Once again it seems that the US and Europe have been caught with their technology down by the Japanese. Which is odd, historically speaking...

The history of the pocket calculator and the digital watch is too well known to bear repeating; suffice it to say that the US companies developed the chips and the Japanese companies cleaned up with the mass sales, leaving US producers like the fledgling Commodore, Hewlett-Packard and Texas Instruments in the mire.

Texas needed the talents of Electric Robb Wilmot to pull the calculator and watch division round, and it was this success that got him the perilous ICL job.

So now, those little calculators that every school child seems to own – and I am proud to maintain my mathematical literacy by using long division on my tax returns – are almost all from Japan.

Dynabook

Still, the US could have learned something from the debacle. It was obvious that very soon the technology would be available for a true pocket computer, converging from various areas of research. And, as far back as 1971 Xerox's Palo Alto Research Center, set up a year earlier to do long-term product research, decided that the 'executive workstation' of the 80s would be what the renowned Alan Kay and the boys called the Dynabook; this was to be no conventional cobbling together of screen, keyboard, and disks but a sort of notebook-sized package like the famous Hitch-Hiker's Guide to the Galaxy. It would have a flat-screen display like the later digital watches, and would be able to link up with bigger computer systems and databases.

> **"To be a hand-held/ portable/pocket computer in my book requires a recognised high-level language for the user to program in...**

This should have given a hint. But remember that this was more than 10 years ago, before the microprocessors, high-density memory chips, and liquid crystal displays we take for granted now, so don't criticise Xerox for not producing the goods.

Even so, as the technologies advanced it still seemed there was a lack of vision in the US. Watches and calculators, yes. Talking language translators, yes, Digital doorbells with 24 tunes (God help us), certainly. But pulling the technological threads together into a pocket computer was left to Japanese firms.

What are the technologies that have made pocket computers possible, and turned the Dynabook from a dream into a possibility or probability? There are three main areas – chips, displays, and batteries.

On the chip front, there was Complementary Metal Oxide Semiconductor (CMOS to we cognoscenti) design. This was one of the early ways of integrating transistors onto a single chip to make a MOS integrated circuit; the complementary bit means that each element of the circuit on the chip is made up of two linked transistors, one built in PMOS and one in NMOS. As you might expect, this type of circuit, using two MOS technologies in each element, took more production stages than straight NMOS and gave much lower circuit densities.

So CMOS was put on the back-burner, and CMOS products were premium-price chips for special applications where their advantages of low-power operation and low susceptibility to power supply fluctuations came in useful. In other words, for battery-powered portable equipment.

Energy savings

But as NMOS designs became more complex and the microprocessor made its appearance, CMOS chips actually became easier to make than many NMOS products and came back to the forefront. RCA came up with the CDP 1802 CMOS micro, and CMOS memory and logic chips started to come off the lines. Energy-saving became fashionable.

Still, even in CMOS the pocket computer was a tricky proposition. Displaying computer information has long been the province of the cathode ray tube, which even its staunchest supporters admit is a very bulky piece of kit. Open up the nearest micro and take a look; it's a good bet that the CRT takes up most of the room inside. Even worse, a CRT display takes up a lot of electrical power and a portable computer is not much use if displaying information drains your batteries in minutes rather than hours. Light-emitting diodes were a better bet, the familiar little red lights you now see twinkling on any old bit of electrical equipment. These were in fact used in the early digital watches, but were not a great success.

As an example, consider Uncle Clive Sinclair's Black Watch, which displayed the digital time when you pushed a button on the side. This used LEDs for its display, and came in for criticism from people who reckoned that Clive had actually put the clock back 100 years by producing a wrist-watch that needed both the user's hands to operate. Best rest assured that the normally-blank black watch face was no aesthetic gimmick; once again, the power consumption of the LEDs was too high for a long battery life if they were left switched on the whole time.

The liquid crystal display, or LCD, soon came to the rescue. Using some tricky chemical and physical effects involving twisted molecules and polarised light, these displays were cheap to make, easy to read, capable of high-resolution, and – most important – consumed very little power. Their operational life (in years) is short compared to LEDs, but that's nothing compared with the advantages.

So the low-power chips and displays were ready. And then battery research seemed to step up a gear as well, fired by the calculator/watch phenomenon. Exotic materials like lithium, silver, and even sulphur were pressed into service as power sources, and the

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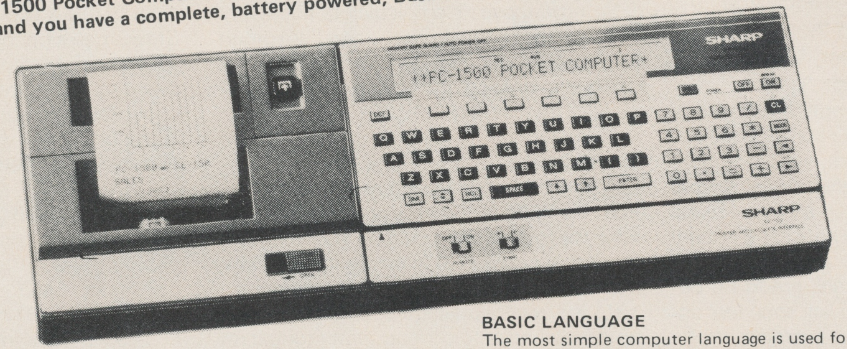

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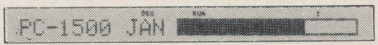

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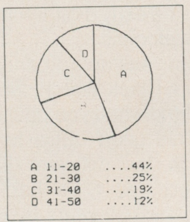
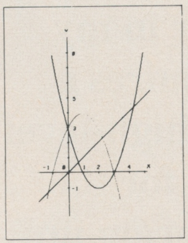


Sales Chart (printout)



Equational Graph (printout)

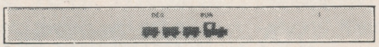
MANAGEMENT APPLICATIONS

Balance sheets, so crucial to management analysis, and profit calculations by break-even point analysis are instantly yours with the PC-1500. By using the integral clock, calendar and alarm functions, this computer can also be used as a schedule reminder.

Computer Graphic (printout)

HOBBY APPLICATIONS

Many popular computer games can be played, including Blackjack, utilising the random number function. Use the clock and alarm for speed games. The Computer Graphics will draw virtually any pattern.



Train (display)

TEMPUS

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BASIC LANGUAGE
The most simple computer language is used for programming ease. Additional BASIC terms provide variables including two-dimensional arrays, variable strings and many other advanced features.

LARGE MEMORY
16K bytes of ROM and 3.5K bytes of RAM, with 2.6K bytes in the user area. Adding the optional CE-151, 4K byte memory module, expands the RAM to 7.5K bytes. An 8K byte memory module will be available soon. The PC-1500 is battery powered and program and data memories are fully protected, even when switched off.

MINI-GRAPHIC DISPLAY
The 7 x 156 dot matrix allows almost any display, including game symbols. Line width is 26 characters and/or numbers.

HIGH SPEED DATA PROCESSING
The C-MOS 8-bit CPU enables swift data processing. Complicated technical or business calculations require far less time.

QWERTY TYPEWRITER KEYBOARD
The first in a pocket computer. Lower case letters are available. With the optional CE-150 colour graphic printer, the PC-1500 can serve as a small personal typewriter. Word Processor software will be available soon.

SIX SOFTWARE KEYS
These can serve as reservable keys, or as definable keys to define programs.

CE-150 4-COLOUR GRAPHIC PRINTER/CASSETTE INTERFACE
Automatic program, data and calculation printing. It prints virtually any drawing in either red, black, green, or blue. Characters are printed in nine different sizes and in lines ranging from 4 to 36 digits in length. You can control the printer completely and direct the printing either up, down, left, or right. As a **cassette interface** it will connect up to two cassette recorders, one for data and program storage, the other for their recall. The CE-150 has a built-in rechargeable battery and is supplied with a mains adaptor, type EA-150.

AVAILABLE SOON
* RS-232C interface. * Software board to serve as input keys in graphics, or pictures, previously drawn on a template. * ROM (MASK ROM) module also applicable. * A wide range of business software.

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PC-1500: 195Wx25.5Hx86Dmm (7-11/16x1x3-3/8") Wt 375g (0.83lb)
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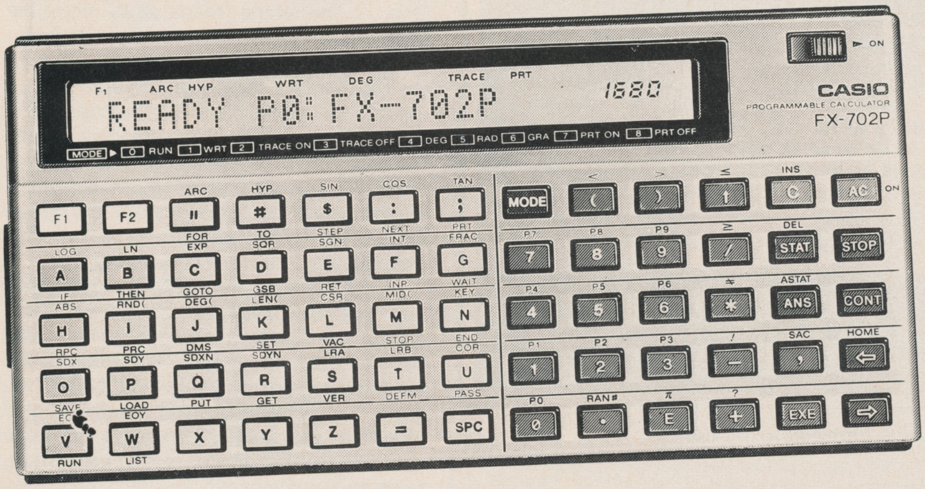

Hand held alphanumeric programmable – BASIC language – holds up to ten different programs simultaneously – subroutines nested up to ten levels – program looping up to eight levels – simplified program editing and debugging – variable programming capacity: between 1680 steps with 26 memories and 80 steps with 226 memories – 55 single key routines including log, trig and hyperbolic – built-in routines include standard deviation, regression analysis and correlation coefficient – all programs and memory data retained even when switched off. *Comprehensive library with over 70 program examples. Optional FA2 adaptor for program storage on cassette and FP10 printer.*

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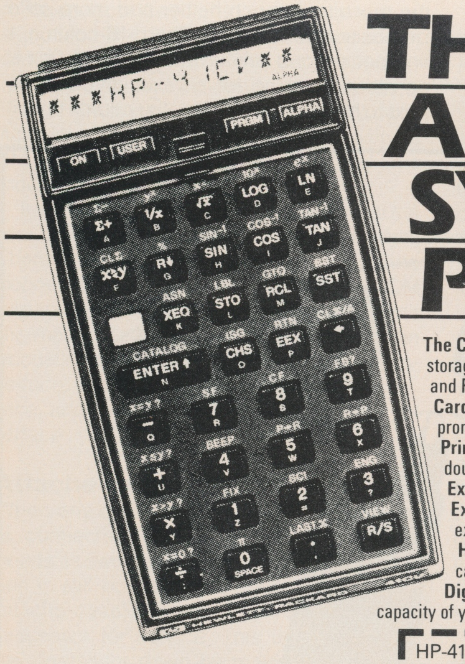

The Calculator. The HP-41CV is the most powerful personal calculator that Hewlett Packard have ever designed. Contains 319 storage registers or 2,233 bytes. Features include alphanumeric capability, continuous memory, enhanced programmability and RPN logic. And when your requirements grow, so does the HP-41CV with a host of peripherals and modules.

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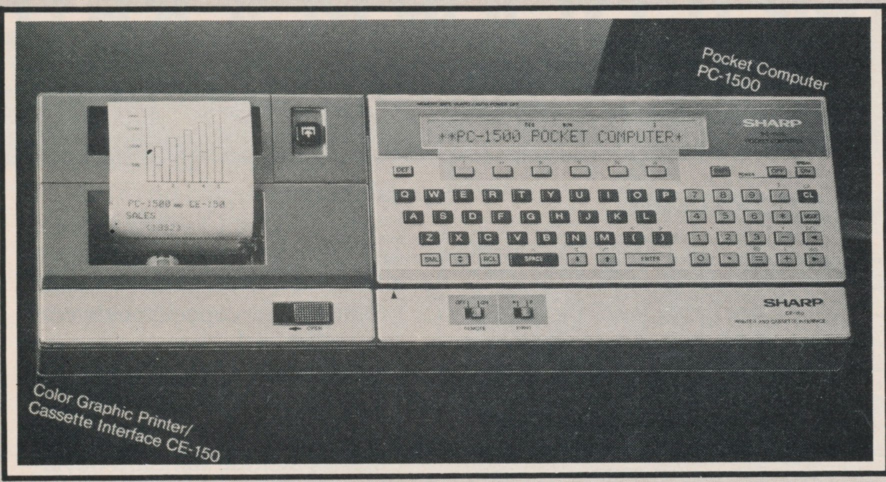
Pocket Computer PC-1500
**PC-1500 POCKET COMPUTER*
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Color Graphic Printer/ Cassette Interface CE-150

Sharp's brand new PC-1500 with detachable four-colour plotter.

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result is that today a tiny single cell can drive a complex combination of electronic circuits for years if necessary – and can then be quickly recharged.

NewBrain

All the bits and pieces were available for a pocket computer shortly after the middle of the last decade. But the first most of us heard about it was in 1980, from two contrasting sources; the National Enterprise Board's own Newbury Labs and the giant Sharp Corporation of Japan (which, as a digression, got its name from its first successful product, a longer-lasting ever-sharp pencil).

Newbury's NewBrain caused something of a sensation when it was launched in the Spring of that year, and deserved the fuss. For here was a portable micro complete with a Z80A, a single-line LCD display, a full QWERTY keyboard, a remarkable number of interfaces, and 32K of RAM expandable to 2M bytes. Even more amazing was that the NewBrain's Basic was provided by a compiler rather than an interpreter.

To be honest, only one of the three models announced was a truly portable computer, and even this one could not be described as a pocket computer unless you are a poacher. But it showed what could be done; in the portable model all the peripheral chips and memory around the Z80 were replaced by CMOS versions of the same products, and the Z80 itself was installed ingeniously so that whenever it was not being used its power supply was cut down to subsistence levels. This is a method of using a standard micro in a pocket machine that we'll come back to later.

A few doubts were expressed at the time about Newbury's ability to make the machines at the stated prices – £199-255 for the various versions – and they turned out to be well founded. Newbury never got the NewBrain into production, the orders that flooded in were never filled, and the whole project was sold off to Grundy last year.

But the second release in that fateful Spring has had a completely different history. It was Sharp's PC-1211, the first real pocket computer if you ignore Hewlett-Packard's publicity for the HP-41C. (And we'll be coming back to *that* controversy as well.)

Qwerty keyboard

If you haven't seen Isaac Asimov with the Radio Shack (Tandy) Pocket Computer yet – the Tandy version is the Sharp PC-1211 with a TRS-80 label glued on – a brief description might be in order. The thing looks like a stretched and beefed-up calculator, and is actually bigger and heavier than the impression you get from photographs; it measures 7 x 2¾ x ¾ inches, and weighs 6oz. You really can put it in your pocket, though I'd reinforce the lining first. The left-hand section has a QWERTY keyboard of calculator-type keys, complete with 'enter' key, with a 24-character single-line LCD above it. The right-hand bit holds a numeric keypad and some function keys, including two cursor control keys (!).

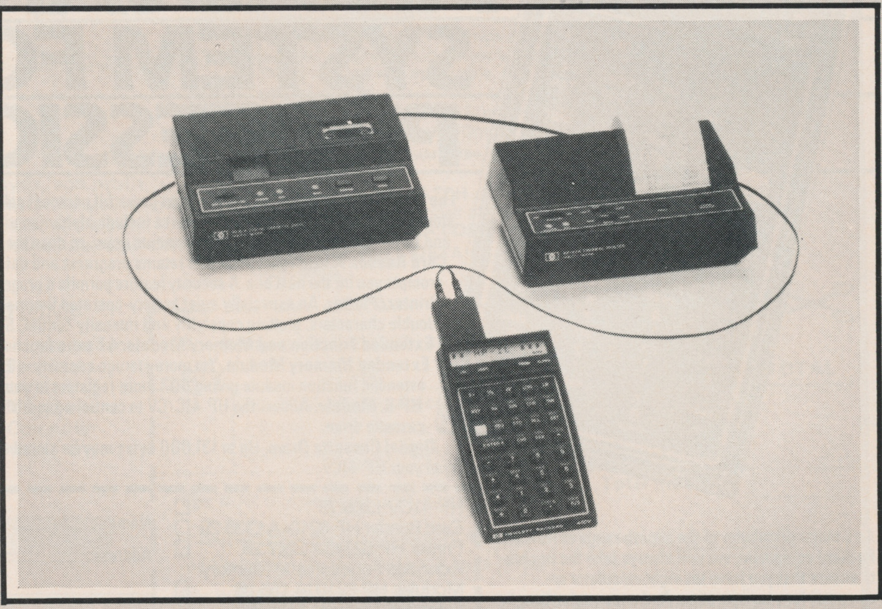
Inside the sleek metal case, the computer is put together in a far from conventional way. Instead of going for a single-chip microprocessor, Sharp designed two four-bit CMOS processors which perform different tasks, each including some on-chip ROM. One of the chips reads data from the keyboard or from RAM, sorts out any arithmetic operations, and interprets statements in the machine's Basic language. It then puts an appropriate set of instruction codes into a buffer; the second processor takes these codes out again and does the actual processing work. This second processor also handles the display processing, character generation, and peripheral control – yes, there are peripherals.

As for memory, three CMOS RAM chips each hold 512 bytes, and the three ICs that control the display each have an extra 128 bytes of RAM. Taking away the RAM needed for the processors' instruction buffer, the input display buffers, fixed memories, and other bits and pieces, the user is left with a grand total of 1,424 bytes of RAM to put programs in. You may scoff, but that's 400 bytes more than a ZX-81 gives you, and there is enough room for a number of fairly worthwhile programs.

The Basic used has a few peculiarities; there is no DATA statement, and no multidimensional arrays or random number generation. ON...GOTO and ON...GOSUB are also missing, but you can have named subroutines.

Executive toy

Now the peripherals. Both Sharp and Tandy provide a cassette interface and a combined printer/cassette interface plus printer. Both of these come as plastic units with a slot to fit the Pocket Computer into, which is why the printer interface has to include the cassette interface as well. Using either of these makes the machine a much heftier and more solid proposition, and with the Sharp 16-column, 1 line per second printer attached, the unit is an attractive thing for an executive's desk, next to his Newton's Balls. You couldn't get it



Hewlett Packard's HP-41C – not really a computer, but sophisticated peripheral handling.

in your pocket, that's for sure.

Various ready-written programs, in books and on cassette, are available from both Tandy and Sharp.

When it was first seen in the US, at the 1980 West Coast Computer Faire, the general feeling was that the Sharp PC-1211 was a gimmick. The price, around $275, seemed high for what looked like a souped-up calculator. But sales have gone well, particularly as a result of the Sharp/Tandy deal, and the new Asimov-backed sales push co-incides with a lower price of a shade under $200. The PC-1211 is advertised in UK magazines as low as £80-£90.

And that is not the end of Sharp and Tandy... but let's stay chronological.

The next big stir came late in 1980, as a result of an odd collaboration between the Japanese giant Matsushita and a T-shirt-and-jeans start-up in San Francisco, tautologously called Friends Amis. Friends Amis, a spin-off from games king Atari, produced a language translator (portable, of course) that was sold by Craig, Quasar and Panasonic in the US. Now, both Quasar and Panasonic are fronts for Matsushita across the Pacific, and the combination of US expertise and Japanses production power soon came up with a product that has been variously called the HHC – hand-held computer, geddit? – RLH-1000, and The Link.

This had more in common with the lamented NewBrain in operation, although visually it is just like the Sharp/Tandy machine, with its QWERTY keyboard and single-line LCD panel.

The difference lies in the processor; the Panasonic/Quasar computer (both firms were to market it in different colours) uses a standard NMOS 6502 running at 1MHz, with a 'power-down' circuit to cut its power consumption. The rest of the electronics is in CMOS, including 2K of RAM expandable internally to 4K and externally to a theoretical limit of 4M bytes; 16K bytes of ROM, with slots for a further 64K and a top capacity of 4M bytes externally; and a built-in real-time clock.

It is when you get to the peripherals that the real power of the machine can be seen. There is a bus expander unit that allows the connection of – take a deep breath – a ROM expander, a RAM expander, a 16-column thermal printer, a 110/300 baud modem, an acoustic coupler, a 1200 bits/s cassette interface, a 16 line x 32 column colour TV interface, and, we are promised, a floppy disk interface.

Attache case

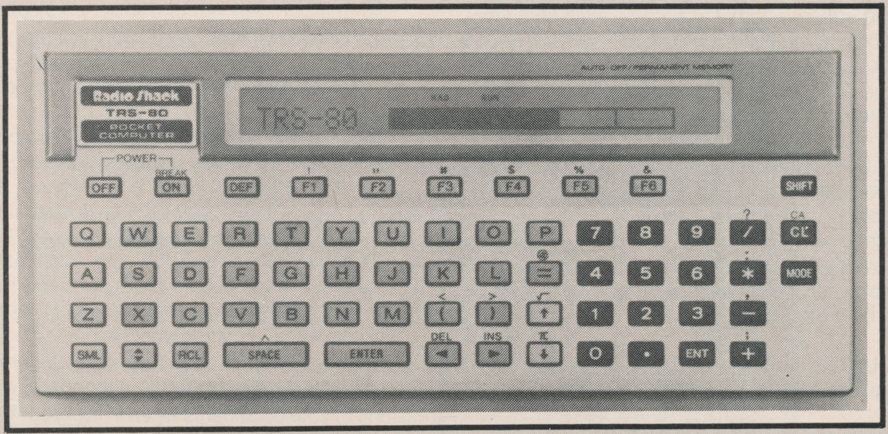
When any combination of these peripherals is connected (and only the TV interface needs its own power supply, so the combination is still portable in a specially-designed attache case) they work by interrupting the processor for service. This avoids slowing the processor down by making it poll non-existent peripherals.

The HHC executes two languages; Basic of course, and a Forth-like language called Snap. These are provided as ROM capsules, using a method developed by Friends Amis for its translators.

This keyboard is a bit easier to use than Sharp's, since the Panasonic machine is physically bigger and the keys are further apart.

And talk of keyboards brings us to the next contender, from watch and calculator leader Casio. The name the company has chosen for its pocket computer, fx-702p, shows that it is seen as an extension to the existing calculator range, where the last two type numbers were fx-502p and fx-602p.

The first thing you notice is that the Casio is squarer than the PC-1211 or the HHC, and that it has a keyboard laid out in ABCD... style rather than QWERTY. The display is smaller too, giving only 20 characters. But the numeric pad missing from the Panasonic system is back.



Tandy's badge-engineered version of the Sharp PC-1211, the first pocket computer.

Although not up to Panasonic levels, the fx-702p has more RAM than the Sharp, 256 bytes more to be precise. The Basic is more 'standard' too, with better array and string handling. And there is also the Sinclair-like feature that each letter key has different functions – a single keystroke gives you a full Basic keyword.

The only interface available to date is the same FA-2 cassette adaptor provided for the fx-602p calculator, once again showing the pocket system's lineage. And the program library consists mainly of scientific programs for the 502p and 602p calculators, translated into Casio Basic. Recommended price is around £135.

And now to get right up to date. In the last month or so two new pocket computers have emerged into the spotlight (if you ignore the much-delayed official launch of the Panasonic HHC). The first is Sharp's second attempt – and so, naturally, Tandy's second bite too – the PC-1500. At the time of writing there was not much detailed information on this contender (as Magnus Magnusson might say), but the esteemed editor of *Micro-Computer Printout* has had one backhanded to him, so expect a fuller report in due course.

From what I can glean, the PC-1500, to be sold as the PC-2 by Tandy, has a new custom 8-bit microprocessor to replace the two four-bit chips of the PC-1211 – but still in CMOS of course. There is an enhanced 12K ROM Basic, and 3.5K bytes of CMOS RAM with an extra 4K as a plug-in option. The full QWERTY keyboard is extended by the addition of six programmable function keys, twice as many as the Panasonic.

Colour printer

Most interesting of all, Sharp has conjured up a tiny optional printer that can produce graphic plots in *four colours*, green, red, blue, and black. Prices have just been announced at £170 (ex. VAT) for the PC-1500 itself, £150 for the printer/cassette interface (CE-150) and £50 for the 4K add-on RAM.

And the latest thing of all is the entry of Seiko, world's biggest watch-maker and Epson and Seikosha printer giant, into the pocket computer business. Under the Epson name, the HC-20 is so new that just about all I can tell you is the weight – 3.5lb – and the US price – around $750. But I hear that it is very similar in concept to the Sony Typecorder, the typewriter-like keyboard, single-line display, and a micro-cassette drive a la Philips dictation machines.

That is by no means the end of the flood, as companies try to grab a piece of the $750m market Egil (remember him?) predicted to 1985. And the calculator firms are not giving up either. Hewlett-Packard is now calling its HP-41C, previously just another programmable calculator, a hand-held computer. The company does have a point; magnetic card readers, high-speed mini-cassette recorders, bar code readers, and a thermal printer are available as plug-in extras. Along with an extremely sophisticated ring interface system for connecting them all together.

But we have got to draw the line somewhere, or I would never get this article finished. For instance, what about the TI-59 and other programmables? And what about those portable terminals that squirt data down the phone lines at the end of a salesman's heavy day?

Here I make my stand. To be a hand-held/portable/pocket computer in my book requires a recognised high-level language for the user to program in – say Basic for the sake or argument. Anything else just doesn't make the cut. And so I save myself a lot of further work.

These pocket things, even meeting my criterion, are coming fast. So strengthen those pockets – and remember you read that advice here first.

Computers in

by Simon Hoggart

It was the SDP which first got me interested in applying computers to politics. Their idea of using credit cards was so sensible. Other parties send elderly ladies, or men in shabby cardigans, round from door to door collecting subscriptions. There's no way anyone is going to hand over more than 50p at the door. But people will pledge a small fortune over the phone. By the time you regret it, a month later, there's nothing at all you can do about it.

So it should be easy to make the logical leap and use the microcomputer to solve a host of different and difficult political problems. A glance over the ZX81 keyboard reveals that BASIC might have been devised solely for use at Westminster. I have provided a brief glossary:

PLOT: to conspire with others against a political opponent.

UNPLOT: what to do when the press gets hold of the story, e.g. 'It is disgraceful to suggest that I would so such a thing to a valued colleague'.

$: money

CHR$: old age pensioners' Christmas bonus, always discussed as if it came out of the Minister's own pocket.

GOSUB: give a subsidy to an ailing industry, as in **GOSUB BL $ 10000000** ('give British Leyland another ten million'). Until last year Sir Keith Joseph's personal key.

LIST: itemise opponent's shortcomings.

LOAD: drink too much in Commons bar while awaiting a vote.

INPUT: drinks consumed in Commons bars while awaiting vote.

LLIST: stutter produced by excessive **LOAD** in Commons bars.

POKE: activity enjoyed in private office while awaiting vote.

SIN: see POKE

COS: see above, with more than one person.

SCROLL: impressive looking paper designed to give credibility to otherwise absurd speech.

PAUSE: rhetorical trick designed to ditto.

PI: attempt to convince listeners that you would never be guilty of the heinous transgressions of your opponents when in fact you did exactly the same when you were in office.

SGN: to append your name to a motion which, while you do not agree with it, will cause two hundred of your constituents to write angry letters in green ink if you don't.

IN KEY: what your fingers are after too much **SGN** with a leaky biro.

IN KEY$: metaphorical, implying 'caught with fingers in the till'.

CLEAR: being defended by the Prime Minister after you have been caught red-handed **IN KEY$.**

LEN: a rough-hewn, horny-handed, salt-of-the-earth Labour MP.

VAL: a secretary. See **POKE.**

: Unparliamentary expression.

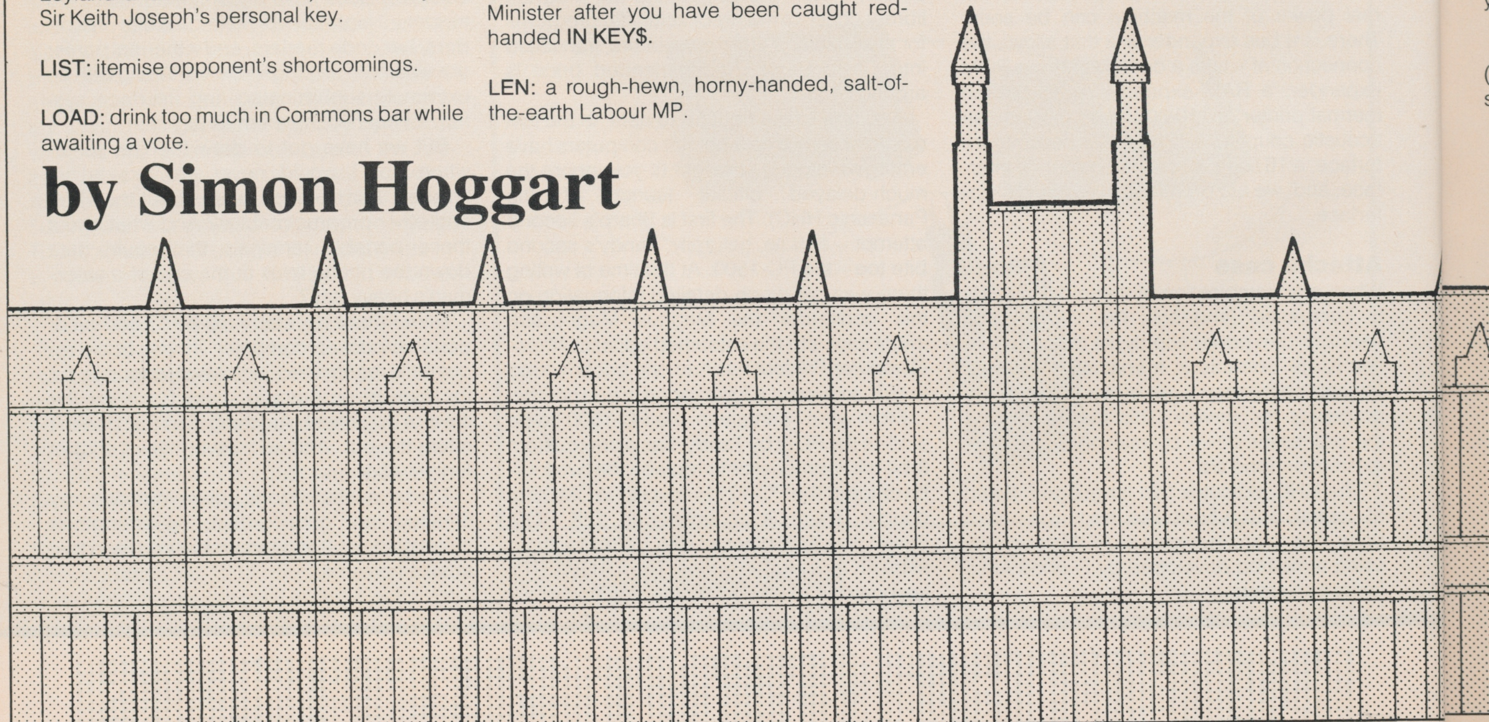
" ": useful content of most speeches.

ABS: absent, which many MPs are on Mondays, Fridays, and while on parliamentary delegations to exotic tropical countries.

TAN: result of going on parliamentary delegation to exotic tropical country.

GOTO TAN, POKE, LOAD: purpose of an ideal parliamentary delegation to exotic tropical country.

Now and again, someone suggests using a computer to simplify the voting at Westminster. At the moment, whenever a 'division' is called, all 635 MPs, or however many are present, troop off into the long, book-lined corridors known as 'division lobbies' and shuffle slowly past a clerk sitting at a high desk. He marks off their names on a sheet of paper large enough to cover your sitting room wall, and after everyone has marched past, the result is announced. The whole operation takes about 15 minutes, of which around 14 minutes 55 seconds are spent queueing and five seconds voting. If, as occasionally happens, there are ten or



n Politics

more consecutive votes on detailed amendments to a bill, an MP can spend three hours doing nothing whatsoever except standing in a queue.

It should be the easiest thing in the world to get this time-wasting process onto a computer so that an MP can sit at his desk or on the green leather benches and not only punch in "Aye" or "No" to the specific question in hand, but tackle such problems as "If Amendment 24 is passed, should we then drop Amendment 25?" or, "If you are against the Bill, would you switch to supporting it if we threw in Amendment 39?"

There's a lot of resistance to this idea, partly because MPs are probably the most tradition-minded people in the country, partly because previous experience elsewhere has been so very discouraging.

Euro glitch

Take the splendid new electronic voting system in the European Parliament building in Strasbourg. It was built by the Italians (like those indicator boards at stations which tell you that the 10.15 train will be going to QWXPBVJW, calling at YTLMFZ) and the plan was that it would flash up the result of each vote within half a second of the last legislator making up his mind. To stop anyone fraudulently casting votes for people who were absent, each MEP (or Member of the European Parliament) was given his own magnetic card. He or she slotted it into the console on the desk, punched 'Yes' or 'No' (or 'Ja' or 'Nein' or whatever) and Bob was your uncle.

Except that it never actually worked.

Static electricity generated by the carpets (or so they thought; it might have been rubber soles) so confused the computer that it flashed up a series of random numbers. Votes would have to be re-taken, and a completely different series of numbers appeared. Even when the system had been de-bugged, the losing side only had to claim that the result was unreliable and the vote ought to be taken again – for instance after lunch, when a few of their supporters had got back. And, it appeared, some MEPs were (quite disgracefully) lending their magnetic cards to their friends to vote on their behalf. When a vote was called, a few were dashing from seat to seat, popping in the cards, voting as freely and frequently as an Irish corpse.

So computerisation may not come to Westminster yet. But there's no reason on earth why it shouldn't be used by the political parties in the country – especially by the SDP. The Social Democrats have pledged to consult their membership on more or less every important topic. This is all very well. But there really is little point in asking someone a single question: "Should we ban the bomb?" for instance. "Should we ban the bomb even if the Russians invade Poland?" might be a bit more useful. "Should we ban the bomb even if the Russians invade Poland and it turns out that the Trident missile system is going to cost more than the predicted £5 billions. Or £10 billions. Or £1 trillion?"

For eons now the electors have been asked, in effect, one simple question: do you vote Tory or Labour? And their answer, which often depends on such vague consideration like 'it's time to give the other lot a chance' has been taken by politicians as the excuse to do exactly as they please with the British economy, the country's defence, the educational system, the health service and the problems facing the nation's paperclip industry. It's possible for a Government to go

▶

against the wishes of 90 per cent of the country's population while behaving in a perfectly legitimate and democratic fashion.

Parliamentary Competition

So what we need is a computer program to get around this problem, and we invite readers to send in their suggestions. The program should be devised to work out, in as much detail as possible, the voters' views on one particular topic – defence, taxation, fox-hunting, abortion, the paperclip industry – you name it.

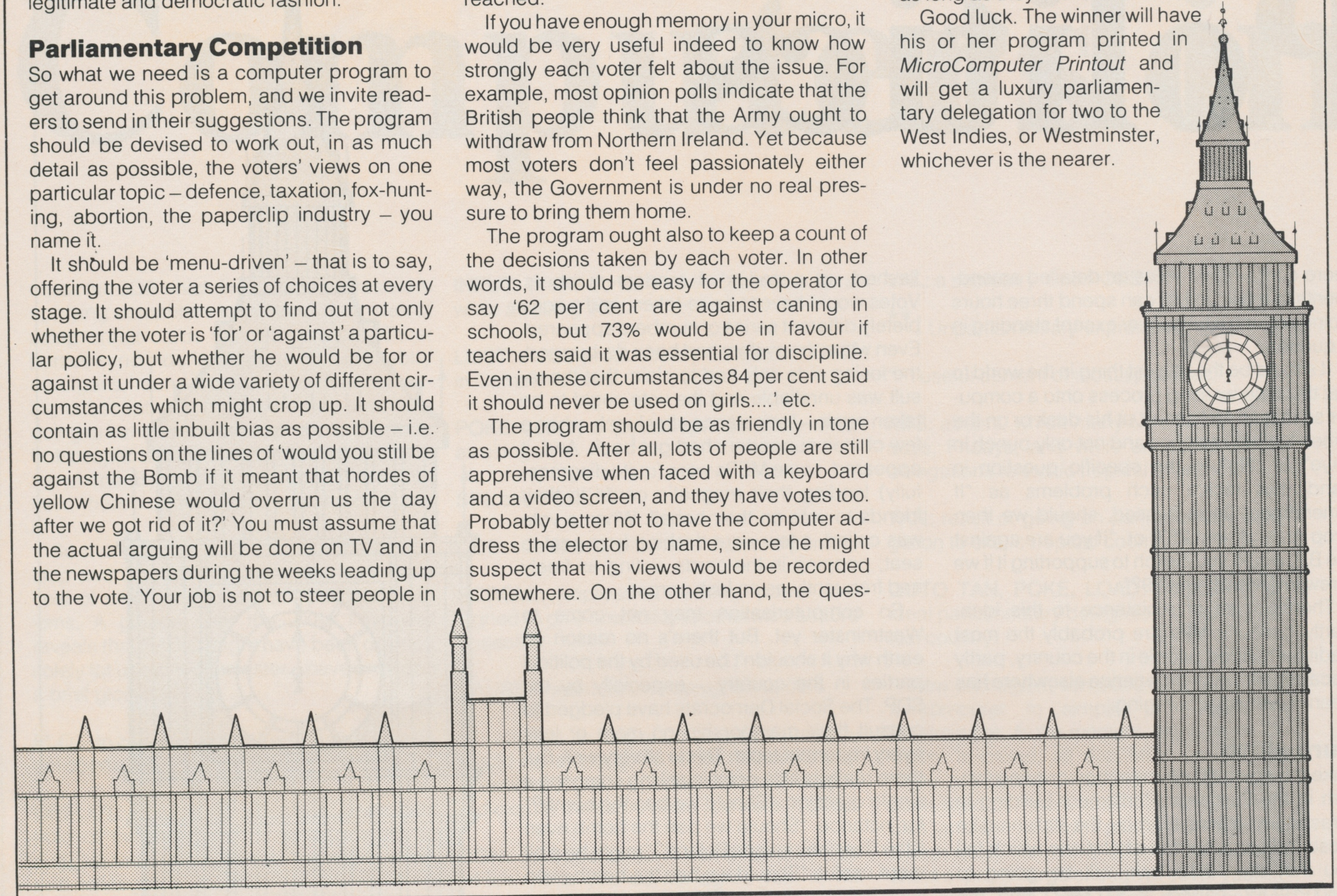
It should be 'menu-driven' – that is to say, offering the voter a series of choices at every stage. It should attempt to find out not only whether the voter is 'for' or 'against' a particular policy, but whether he would be for or against it under a wide variety of different circumstances which might crop up. It should contain as little inbuilt bias as possible – i.e. no questions on the lines of 'would you still be against the Bomb if it meant that hordes of yellow Chinese would overrun us the day after we got rid of it?' You must assume that the actual arguing will be done on TV and in the newspapers during the weeks leading up to the vote. Your job is not to steer people in one direction or another, but to work out precisely what conclusions they have already reached.

If you have enough memory in your micro, it would be very useful indeed to know how strongly each voter felt about the issue. For example, most opinion polls indicate that the British people think that the Army ought to withdraw from Northern Ireland. Yet because most voters don't feel passionately either way, the Government is under no real pressure to bring them home.

The program ought also to keep a count of the decisions taken by each voter. In other words, it should be easy for the operator to say '62 per cent are against caning in schools, but 73% would be in favour if teachers said it was essential for discipline. Even in these circumstances 84 per cent said it should never be used on girls....' etc.

The program should be as friendly in tone as possible. After all, lots of people are still apprehensive when faced with a keyboard and a video screen, and they have votes too. Probably better not to have the computer address the elector by name, since he might suspect that his views would be recorded somewhere. On the other hand, the questions should be patiently spelled out and the voters should know that they have as long as they like to answer.

Good luck. The winner will have his or her program printed in *MicroComputer Printout* and will get a luxury parliamentary delegation for two to the West Indies, or Westminster, whichever is the nearer.



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HARDWARE

HOW IT

How does your computer actually work? What are all those small, black chips surrounding the microprocessor and what are they for? **Chris Preston** explains the fundamentals of hardware design in terms the complete beginner can understand.

A quick scan of the computer section of your local bookshop will turn up a vast number of books dealing with programming at all levels. There are not too many books describing hardware which are aimed at a beginner. Even *MicroComputer Printout* is not renowned for its coverage of the subject. This short series of articles aims to put right this lamentable state of affairs. In order to restrict ourselves a little bit though, we will only look at *digital* hardware, which after all is the meat of the computer. All machines do have some *analogue* circuitry to drive the screen and cassette or disk drives. The difference is that in digital circuitry, all the information is carried either as 1's or 0's; analogue information is like sound information: the level of the signal varies continuously between limits.

To most home computer users, what happens under the lid of their machine is a complete mystery. Yet contrary to popular opinion you do not need a degree in electronics to be able to understand the basics of hardware. In fact, as hardware is *completely* logical, it is in many ways a lot easier to understand than software! Nearly all the hardware which goes to make up a computer is composed of building bricks called *gates.* Even the most complex chips are composed of large numbers of gates. If you open the lid of your computer, you will see many chips of all sizes scattered about. The gates we will be looking at first are the small ones with either 14 or 16 legs. On the top of the chip will be a type number beginning with "74", which may be followed by "L" or "LS", which just mean there is a small difference in the chip's power consumption or speed without altering its function. The number ends with another two or three digits which determine the actual type of gate. One package may contain between 1 and 6 gates of a particular type. Here is a very simple gate, called an *inverter*. Its type number is 7404.

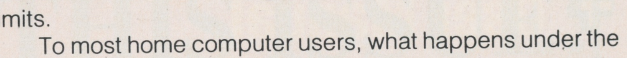

Diagram 1

An inverter has two wires, or lines, associated with it, one *input* which we have called A, and one *output* called Q. As its name suggests, an inverter turns signals upside down. If we

WORKS

send a 1 into an inverter, we get a 0 out; if we feed it with a 0, it gives us a 1. Instead of talking about a line being a 1 or a 0, we often talk about it being true (1) or false (0).

We can describe the action of the inverter in a *truth table*. A truth table is just a diagram which allows us to show what outputs a gate will give us depending upon what inputs we feed into it. Here is the truth table for an inverter:

A	Q
0	1
1	0

This clearly shows that whichever state the input A is in, the output Q is in the opposite state. All this is very well, but exactly what is a '1' and what is a '0'. The two levels are defined by voltages. The normal supply voltage used in a micro is 5v (which is no higher than the output of many domestic batteries), and so we say that if an output is at 5v then the output is a '1'. If the voltage is at zero volts, then the output is a '0'. In practice, however, mass-produced chips are not identical, so we say that anything above about 2.5v is a '1' and anything below 0.5v is a '0'. If the voltage is in between 0.5v and 2.5v then something is seriously wrong, and the inverter will make its own mind as to what is going to appear on the output; we say that the output is undefined; it could be '1' or '0'.

Once we have studied the truth table and understand what an inverter does, we want a shorter way to describe the action of an inverter. When we come to design more complicated circuits, we will want a short concise way of describing the action of a gate. A sort of algebra has been designed to allow us to describe the action of combinations of gates. Using this algebra, we can write the action of an inverter like this:

$$Q = \overline{A}$$

Diagram 2

This is pronounced "Q equals not-A" (not-A meaning the opposite or inverse of A).

What other gates are there? Two other very common gates are the AND gate and the OR gate, but both of these have two inputs instead of one:

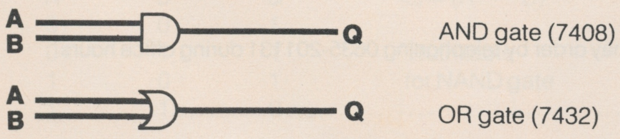

Diagram 3

The action of these gates is equivalent to the BASIC operators AND and OR. The AND gate gives an output if *both* its inputs A and B are 1's. The OR gate output will be true if *either* (or both) of its inputs are true. Here are the truth tables and algebraic definitions for these two gates:

A	B	Q	Q = A B
0	0	0	
0	1	0	
1	0	0	Truth table
1	1	1	for AND gate

A	B	0	Q = A B
0	0	0	
0	1	1	Truth table
1	0	1	for OR gate
1	1	1	

The two symbols and are very easily confused. The method I have found easiest is that looks like an 'n', which is the middle of aNd. If you can remember this, then must be OR by the process or elimination.

What can we use these gates for: Let us consider a piece of equipment containing a motor. We will not bother ourselves too much about what the equipment is or what it does and only look at features which concern us. In the interests of safety, we want to stop the motor whenever someone opens the door of the equipment. We have a signal from a switch on the door called DOOROPEN which becomes true whenever the door is opened, and a motor controller with an input, MOTORON, which turns the motor on whenever a 1 is applied on the input. In other words, whenever DOOROPEN is true (the door is open), we want to set MOTORON false. This is obviously a case for an inverter:

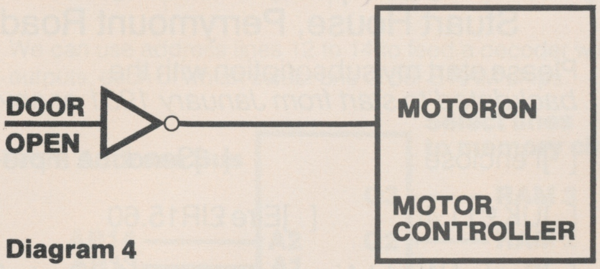

Diagram 4

Now let us add an extra complication. The motor is to be controlled from a time switch, so that it only runs at certain times of the day. The time switch gives us a signal TIMEON which is true when the time switch wants the motor to be turned on. Before we can design a logic circuit to carry out this function, we must be clear about what we want the circuit to do. We can use the algebraic expressions for the gates to do this. We want the output from the circuit, MOTORON, to be

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true when TIMEON is true and DOOROPEN is false. We can write this:

MOTORON = TIMEON   DOOROPEN

In other words, we say "MOTORON equals TIMEON and not DOOROPEN". From this we can develop the following circuit:

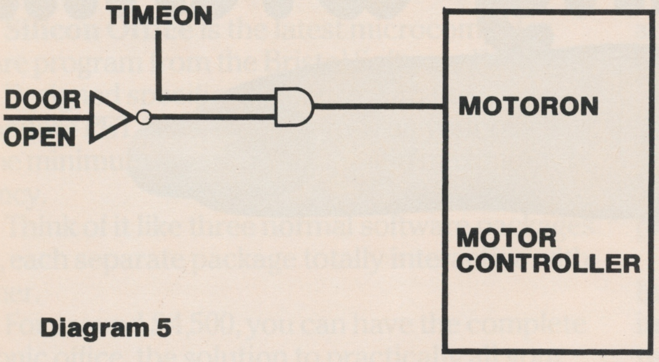

Diagram 5

As an exercise, those of you who are so inclined can add a manual switch, so that an operator can force the motor to be on regardless of what the time switch is saying. The motor should still be turned off if the door is opened, however. Don't fret if you get stuck, we will print the answer in next month's issue.

The three gates we have looked at are in fact all we need to develop any circuit which just involves looking at the level of various inputs and producing a number of outputs. The word for this kind of circuit is 'combinational' or 'combinatorial' depending on where you were educated! Several arrangements of more than one gate crop up again and again, and so chip manufacturers also produce chips to carry out these functions, to save us a bit of trouble. One of these, the Exclusive-OR, is also a BASIC operator.

Here is its truth table:

A	B	Q	Q = A B
0	0	0	Truth table
0	1	1	for exclusive-OR
1	0	1	gate (7486)
1	1	0	

From this we can see that the output Q is true, if A or B, but *not both,* is true, that is Q is true if A and B are different. See if you can design a circuit using the basic three gates, AND, OR and NOT to produce an exclusive-OR gate.

Two more gates will complete our list. The first is the NAND gate, 7400, which is just an AND gate followed by an inverter:

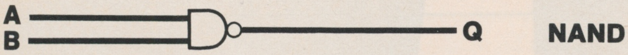

Diagram 6

A	B	Q	Q = (A B)
0	0	1	
0	1	1	Truth table
1	0	1	for NAND gate
1	1	0	

Notice that the column under "Q" in the truth table can be worked out by applying an invert operation to the "Q"- column of the AND gate.

The second new gate is the NOR gate, 7402, which is an OR gate followed by an inverter:

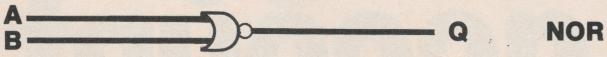

Diagram 7

See if you can work out its truth table from those of the inverter and OR gate.

We will now look at a chip which contains quite a large number of gates. It is called a decoder, 74138, and is used in pretty well all computers. A typical device may have 3 inputs (A0 to A2) and 8 outputs (Q0 to Q7):

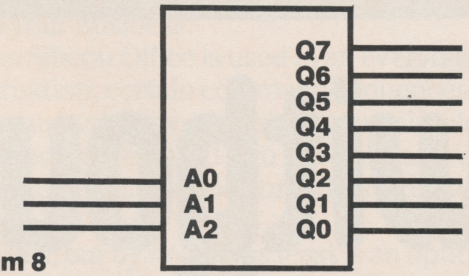

Diagram 8

The way this device works is really quite simple. If we think of the 3 input lines as forming a binary number in the range 0 (000) to 7 (111), then each number causes the corresponding output to be true. For example if A0=0, A1=1 an A2=1, this forms the number 110, that is 6, so output Q6 will be true. The most common use for this device is in selecting different parts of memory. The memory of our computer may be composed of a number of RAM chips, each 4 kbytes big. Each RAM chip will contain 4096 memory addresses, that is $1000 in hexadecimal. When the processor wants to access memory location $2000 or $3000, we need to select RAM2 or RAM3 respectively. By feeding the correct bits of the address into a decoder chip, we can use the outputs to select the correct RAM chip. Each RAM chip contains $1000 elements, 0 to $FFF, so we will need 12 address lines going to each chip, A0 to A12. If we think of the address as a 16 bit binary number, we can easily see which lines we need:

15 14 13 12	11 10 9 8	7 6 5 4	3 2 1 0
3	0	0	0

We can use address lines 12 to 14 to feed a decoder with 8 outputs, each of which select one of our 8 RAM chips.

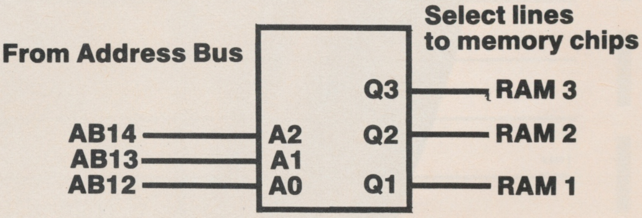

Diagram 9

This is a good example of how much easier it is to work in hexadecimal when dealing with the nuts and bolts of computing! Next month we will be looking at how the different parts of a computer, processor, memory etc. are linked by the various buses.

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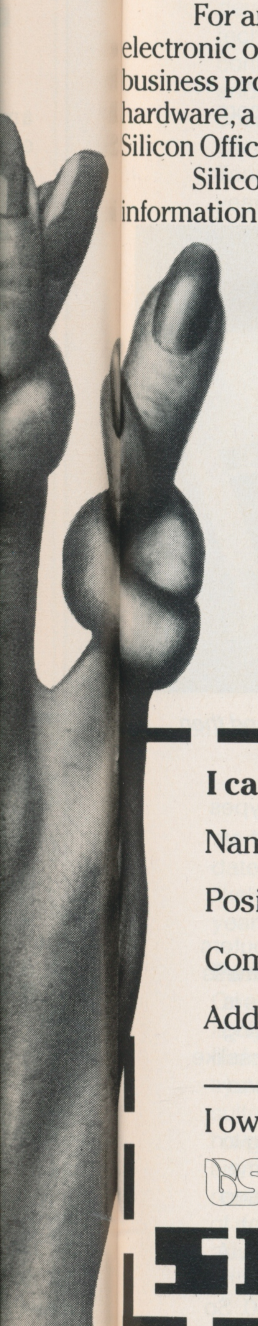

Silicon Office is the latest microcomputer software program from the Bristol Software Factory.

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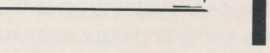

Can I upgra

Dear Sir,

I am considering the purchase of a microcomputer, possibly BBC Model B or equivalent, but am unable to find out whether it would be suitable for tasks I have in mind for the future. Your magazine invites "confused" readers to write to you, hence this letter.

Initially I intend using the computer for learning to program, games, etc., but as my practice grows I will want to use it for accounting-book-keeping services to my clients (ledgers, wages), production of accounts from incomplete records and word processing.

I should be grateful if you would let me know whether it would be possible to expand, say the BBC B, with the addition of disk drives, printer etc. so as to be able to handle the above tasks. And if so, would it be advisable to do so or would it be better to opt for a business system from the outset.

I am fairly new to computing and what little I know about computers is largely due to your magazine. I look forward to your reply.

D. M. Gudka,
Woodview,
Thorrington,
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First of all, Mr Gudka, I'd like to commend you for your wisdom in asking this question *before* deciding which computer to buy! *MicroComputer Printout's* "confused" advertisement has resulted in a deluge of letters being passed to me by the Editor, primarily asking the same question: Which computer should I buy?

by David Eldridge

It has been an interesting exercise grading these letters into different groups, and I will be dealing with all of the most common misunderstandings and difficulties over the next few issues, so keep 'em coming!

One of the most frequent misconceptions arises because the newcomer is unaware of the difference between a home microcomputer and a business microcomputer.

Reasons for this are manifold. First, quite a few microcomputers can successfully be used in either environment. Furthermore, several of today's more popular business systems have their historical roots planted firmly in the home and education market sectors. PET, Apple and Tandy TRS-80 all come to mind as good examples from the days when a lack of peripherals and sophisticated software meant that business applications required a lot of hard work – and knowledge – on the part of the user.

The situation has been further complicated by the introduction of mass-market low-cost home computers, some promoted with the aid of distinctly dubious advertising claims relating to their suitability for business use.

In previous columns, I have gone into detailed explanations as to what can and cannot be stored in a home computer's memory; where cassette is applicable; and when disks are mandatory (the case for most business uses). The end conclusion is invariably that while a machine such as the ZX81 is excellent for learning to program on, it cannot realistically run commercial applications.

Memory capacity

You, however, clearly recognise the difference between home and business computers, and are asking a far more fruitful question: Can a home computer with good expansion facilities be upgraded to compete with a business system?

Can I buy a BBC computer to learn programming, and then add peripherals for business, later.....

To answer this, I must first outline where the two types of computer differ and where they are similar. Both, for example, can be based on the same microprocessor (usually a 6502 or Z-80) and hence can process at comparable speeds. Differences in RAM memory capacities are not great, either: the better home computers will usually yield up to 32K bytes, and while some business machines have 48K, 64K or more, a large chunk of this is used *instead of ROM* to house the language or operating system. Though the trend now is towards more businesslike languages, notably Pascal and COBOL, most home *and* business computing is still done using BASIC.

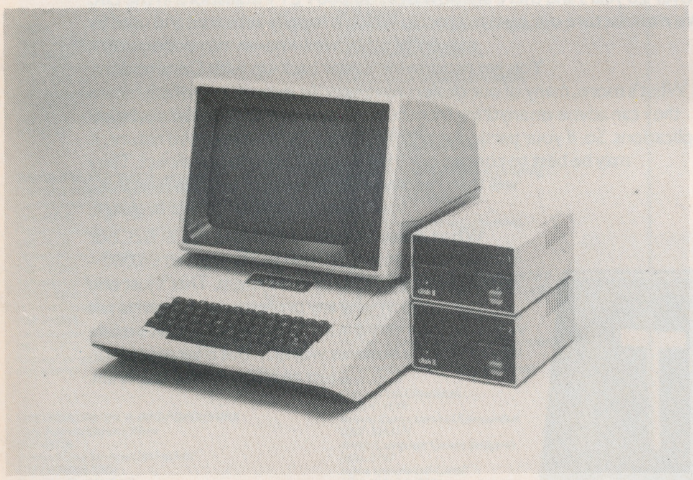
A business BASIC will contain commands relating to storage of information on disk, whereas BASICs in home computers major on the handling of colour, graphics and sound (though BBC BASIC copes admirably with both). Keyboards are similar in functions, as are screen sizes. A business computer will opt for the maximum number of columns, though, again, the BBC B scores well with 80. So

or, Which computer should I buy?

rade, later?

where do they differ?

It should be stated that considered purely as a CPU (i.e. a computer without peripherals), home computers these days offer far better value for money than business computers. They have colour, sound, graphics, plug-in cartridges and interfaces for joysticks, light pens and all manner of other goodies. This is primarily because purpose-built home computers are a more recent development and have taken advantage of advances in technology – particularly in the area of video/sound controller chips and the use of Uncommitted Logic Arrays and related devices to replace the myriad of discrete but unsophisticated logic circuits previously required. Compare, for example, the BBC with the PET, Apple and Tandy – all of which have changed little over the past four years.



..... or should I buy a business system from the outset?

New, purpose-designed business computers are now starting to appear on the market which make use of up-to-date technology. The Sirius 1 *(see feature last issue – Ed)* is likely to set the trend for developments over the next two years. But why are the PET, Apple and Tandy's still selling?

Peripherals

One answer is peripherals: business systems are more likely to have peripherals designed for business use. The disks have higher capacities and the disk operating systems (DOS) can handle the kind of record structure best suited to commercial transactions. (This is not always true, however, as the capacity of a single drive disk can be anything from 90K to 1.2MB). Printers are faster, have more readable typefaces, and are of a more rugged design. And of course when buying a business system, it is a decided advantage not to have to purchase each component from a different supplier.

Yet this distinction is fading rapidly. Modern home computers (the BBC B included) have RS232 interfaces that enable them to drive *any* printer of your choosing, and the Commodore VIC can drive all of the sophisticated PET peripherals.

Physical design, though, remains a valid, but often overlooked, distinction – both from the viewpoint of reliability and ergonomics (convenience of use by operator). Under the first heading, an all-in-one or integrated design is going to stand up to prolonged use better than one which relies on an external power supply, UHF modulator and a host of interconnected add-ons resembling Spaghetti Junction. There is, however, a great deal of controversy as to whether built in disk drives are a boon or bane.

Good ergonomic design is rare on all but the latest generation of computers – outside the advertising slogans but, generally speaking, a business computer will have a better laid out keyboard with good 'feel', and a sharper screen display that is less likely to induce operator eyestrain.

Software

But far and away the most important difference is software: indeed, the best axiom for selecting a business system is to look first for the software package(s) to meet your requirements, and then see which hardware it will run on. Generally speaking, the larger the installed user base of any one system the greater the range and quality of business software available for it. Which is why the PET, Apple and Tandy still do so well, not to mention the others *(see Which Business System, this issue – Ed)*. Even given sufficient time, the most popular home computers are unlikely to catch up; because most development emphasis will be in the fields of entertainment and education.

There *is* one way in which a home computer can access a whole library of business packages, and that is via the standard operating system, CP/M. Certainly, there are some excellent word processors and Calc programs that will run on any CP/M machine (which usually means one with a Z-80 microprocessor and 64K of RAM). However, programs written under CP/M generally can't take advantage of the individual features of a particular machine, such as programmable function keys and good screen layouts. Hence some of the most user-friendly and powerful programs are written only for one particular machine.

So much for the generalities; now let's look briefly at how well the BBC B machine could be upgraded to a business system. Though based on a 6502 microprocessor, the design incorporates a clever system called 'The Tube' which allows processing to be passed to an external processor. The manufacturers are planning to produce a Z-80 device (which would run CP/M) and one to run Motorola's powerful 16-bit processor, the 68000. So given time, the BBC micro will be able to run a certain amount of existing software, though I would doubt that much will be developed specifically for this machine, at least in the ▶

IF ANY OF THE FOLLOWING WORDS GIVE YOU A BUZZ . . . ANALYSIS STATISTICS DESIGN PLOTTING GRAPHICS REPORT WRITING SPECIFICATIONS SCHEDULES COSTING PLANT MAINTENANCE PRODUCTION CONTROL SIMULATIONS IEEE INTERFACING INSTRUMENT CONTROL MONITORING TERMINAL COMMUNICATIONS PAPERTAPE READING PUNCHING & EDITING SELF PROGRAMMING BASIC ASSEMBLER LANGUAGE MACHINE CODE **. . . GIVE US A BUZZ (OR SEND BACK THE COUPON)**

The micro comes of age. The PET has come a long way since micros were regarded as toys. It's designed and built for demanding work and this shows in the 32K memory and 80 column screen as well as in its impressive disk capacity. When it comes to languages, you'll find the PET fluent in BASIC, PASCAL, FORTH, COMAL, LISP, PILOT, FORTRAN, APL and ASSEMBLER.

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Who needs PET? And why? The list above speaks for itself, but that's only part of the story as the PET now has over 600 applications. It's good news for any engineer who's tried to get even a modest budget approved – the PET is very acceptable to the most sceptical of money people.

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Can I upgrade, later?

immediate future.

The story on peripherals is similar. Almost any printer can be attached and a comprehensive range of other devices is 'under development'. To date, however, there is little clue as to the capacity and arrival date of, say, the floppy disk.

Physical design

On physical design, the BBC begins to fall down. The casing is rather large for desktop use – particularly as the T.V. screen or monitor cannot be stood on top, and all the peripherals, external processors and so forth will make for a cluttered desktop.

So what *is* my advice? If you aren't completely sure about going into microcomputing, Mr Gudka, buy the BBC machine and have fun learning to program using its extensive graphics and sound capabilities. After a few months, you will soon know if you can live with its design as a business system, and should by then have a better idea as to what peripherals are available.

Don't, however, fall into the trap of assuming you *must* upgrade the system you've bought. The BBC B will cost you £400, any business system (upgraded or dedicated) is going to be nearer the £1500-£2000 mark. So it might be cheaper to sell the BBC and purchase a full business system when you are ready.

If, however, you are committed to computing then buy a PET or Apple (without disks), first, and add the appropriate peripherals as you need them. They are both perfectly good for learning to program on – though of course you won't have the sophisticated colour and graphics.

One final word of warning. Your letter suggests that you intend to write your own business software. Don't underestimate the work involved. The better packages now appearing have many man-months or years or work behind them. Unless you have a really novel application in mind, I suggest that you would be much better off looking at existing packages than writing your own. The functions you mentioned are all heavy-weight applications, requiring very sophisticated programming to run efficiently on a micro.

All the more reason why you should really be looking at a business system from the start.

If you are thinking of buying a microcomputer for a particular application and would like advice through this column, we invite you to send us details. We also welcome correspondence from existing owners regarding their experiences of buying or using any machine.

HAVE YOU MOVED?

If you are moving house, please be sure to let us know your new address so that your copies of *MicroComputer Printout* can be redirected. It would be helpful if you could enclose your previous wrapper.

TEXAS

Texans, as followers of 'Dallas' will know, do things big. Despite this the TI99/4A from Texas Instruments has made only a small impact here. **Richard Pawson** discovered an inexpensive computer, well supported with peripherals and software, that's being sold in a totally different way to its competitors.

SCORE 00000 HI SCORE 00000
TEXAS INSTRUMENTS
TI-99/4A

Newly-launched TI Invaders are 'merely aggressive' or 'downright nasty'!

In order for a new microcomputer to establish itself in the marketplace, it has to be well-supported. When most machines are first launched, however, they are supported not by programs and peripherals, but merely by nebulous promises. "We have en extensive programme of software development under way. Floppy disk and printer are scheduled for next autumn, with a modem to follow," is the usual line. So when a machine is launched, complete with disk, modem, interfaces, memory expansion, printer and a goodly range of cassette, disk and cartridge software already available – that alone bears examination.

The TI99/4A from Texas Instruments is a case in point; perhaps *the* case in point. Launched last September at a price of £299 including VAT, the 99/4A is aimed directly at the home computer market – with excellent colour, graphics and sound. One of the most refreshing things is that the manufacturer has made no attempt to pretend that it can be used for business. TI have not developed the useless (and we use the word advisedly) Payroll and Accounting packages which other home computer manufacturers seem to view as a priority.

Conservative marketing

So with the TI now establishing its distribution amongst computer shops and national department stores it is surprising to find that sales have been only 'moderate'. This can be put down in part to TI's rather conservative marketing techniques (compared with the kind of enthusiasm whipped up by Commodore's new product 'leaks' and the BBC Microcomputer), but the main cause is an historical one.

The TI99/4 was first launched nearly two years ago – intended for the US home computer market. Over here, it needed an American standard colour monitor to achieve the colour graphics, putting the total price up to £1,000.

"Obviously the price tag made the 99/4 less attractive," says Mike Lunch, General Manager of TI's UK Consumer Products Division, "but in many ways the machine was ahead of its time. Two years ago personal computing was firmly in the hands of enthusiasts. The 99/4's strong points – colour, graphics, sound and plug-in cartridges – were criticised by many as being unnecessary. Now the other manufacturers have identified the home market, they have all followed suit!"

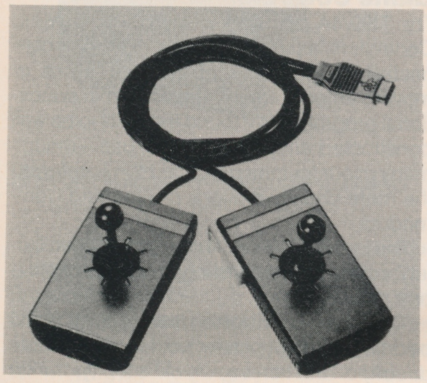
The new 99/4A, however, not only has a PAL interface to drive any UK colour T.V., but sports an improved typewriter-like keyboard and a number of other minor improvements. Those who are familiar with Texas Instruments will be aware of their reputation of quality in every department: construction, design, reliability, documentation and packaging. The 99/4A clearly reflects the company's twin roots: programmable calculators at one extreme and minicomputers at the other. In some features this design origin works to its credit, and in others detrimentally.

One of the greatest strengths of the TI is in its expansion – the peripherals mentioned earlier. It should be pointed out, however, that while the quality of construction is excellent and the specification functional, the units are all relatively expensive and one of them particularly "outstanding". The disk controller costs £200, and then a further £300 for each drive unit, for example. The strength is that a complete system *can* be purchased from one manufacturer. "It's like the camera market," maintains Mike Lunch, "the most common reason for purchasing an SLR is that it can be expanded with a vast range of lenses, wide angle to telephoto. Yet the average number of lenses bought by an SLR owner is only one and a half."

Clearly, most users will stick with the basic 99/4A, using cassettes and cartridges.

Professional use

Those who have a professional use in mind will purchase a complete system – taking the price well beyond £1,000. This includes the programmer who wishes to develop machine code for the 16-bit TMS9900 microprocessor on which the machine is based – since machine code cannot be accessed without disk and memory expansion.



Twin joysticks, or 'wired controllers' as TI have it.....

In our article on Computers of the Future (November 1981), Guy Kewney coined a new phrase: The Convivial Computer. This referred to a machine where the manufacturer makes available all possible system documentation about a machine, thereby encouraging independent suppliers to develop software, peripherals, and the formation of user groups to exchange ideas, information and programs. The TI99/4A is *not* a convivial computer – there is no system-level documentation, nor is there any means of accessing the machine at system level. The lack of PEEK, POKE and SYS commands would leave the experienced enthusiast feeling straight-jacketed – unable to explore and find new tweaks and tricks.

Yet in TI's case this is clearly policy, rather than the more usual reason: incompetence. The machine is aimed at the typical home user who wants to use primarily off-the-shelf packages and perhaps to write a few programs himself – whence the easy-to-use BASIC.

The evaluation below is conducted along the same lines as our *Which Home Computer?* feature in the February issue, but examining each area in more detail. Our test system, which was in use for four weeks, did include all the peripherals – though we have not covered them individually in the evaluation for reasons of space.

Physical Construction

Under this heading we refer both to quality of construction and convenience of design, and, not surprisingly, the TI scores well in both. The computer itself is solid, attractively finished in silver and black, and of a size that makes it equally suitable for use on a desktop, on the floor in front of the telly, or the position most favoured by our boffins: placed across the knees whilst lounging in a deep armchair.

The rugged quality of all connectors for peripherals and expansion give considerable reassurance compared with those of cheaper competitors – where the PCB edge-connectors are prone to both dust and corrosion from 'sticky fingers'. This is particularly true of the arrangements for inserting ROM cartridges or 'solid state software' as the label on the front grandiosly portrays it. The use of a recessed well to guide the cartridge in, and spring loaded doors to protect the connectors was far more satisfactory than some of the other mechanisms we have encountered.

The only thing to mar the configuration was the need for a (bulky) mains transformer and separate UHF modulator (also large) outside the main casing, similar in this respect to Commodore's VIC. For desktop use, these units could be well hidden, but installed on the lounge floor or coffee table made for a rather messy layout.

Both the exterior design and ruggedness are mirrored in the various peripherals – with the exception of the steel-encased disk drive which looks as though it has been bought-in ready assembled from another manufacturer.

The peripherals connect directly together by means of an expansion bus which passes through each device. This eliminates the need for myriad interconnection cables, though each major unit still requires its own mains supply.

However, by the time you have added speech synthesiser, expansion memory, RS232 interface, disk (with controller) and printer, the system is beginning to reach unmanageable proportions. Texas have foreseen this problem and at time of going to press, we learned of their intention to market a 'rack' system with common power supply, into which various peripherals could be plugged, as cards.

It should be remembered, though, that the TI is marketed firmly as a home computer, and though well-supported with peripherals, few installations are likely to upgrade to the full system.

Keyboard

First impression of the keyboard was that it was rather small, with keys closely packed. Measuring up against the office typewriter's, however, showed that this was not the case. Texas say that the whole unit has in fact been cannibalised from one of their terminals. It is the lack of the normal editing functions at either end of the QWERTY bit that creates the impression of smallness – and this omission must be seen as a disadvantage.

It is overcome in part, by the use of CTRL (Control), FCTN (Function), and SHIFT keys to assign multiple functions to each key – including the missing editing functions such as Insert, Delete and Cursor movements. Until well practised, this can give rise to the 'all fingers and thumbs' syndrome – and is certainly not conducive to fast editing.

The use of CTRL and FCTN is partly redeemed by a white plastic strip above the keyboard on which you can write your own labels and legends for the top row of keys – especially useful when writing games, or for use by small children. Several blank strips are supplied with the computer (the idea obviously originates from TI's programmable calculator – the TI59), though, disappointingly, they had not been made use of in any of the otherwise excellent software we reviewed.

Opinion as to the 'feel' of the keys was mixed, from the users we tried it out on. Some said it corresponded well to that of a typewriter, while others felt it was spongy and imprecise. The demonstration unit we tested had evidently seen the wars, and one or two keys had started to become a little stiff.

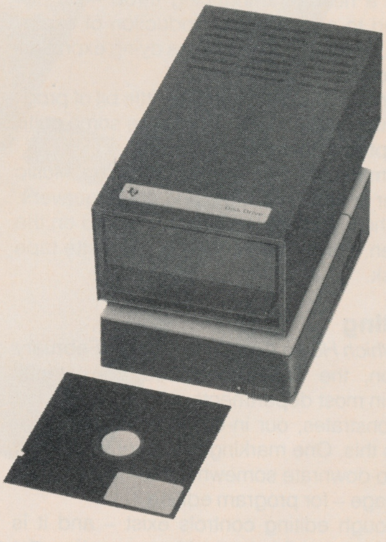
Screen

The screen on a TI99/4A consists of 32 columns by 24 rows of blocks which may hold any characters in any colours. Only 28 columns are available for BASIC text, however, which meant that many BASIC lines had to be split up on the screen.

Unusually, the SHIFTed characters are not lower case, but smaller versions of the same characters. We didn't really like the result, though it may have been done because many people find it difficult to read lower case on a computer screen since letters like g and y do not have true descenders. Any or all of the character set chould be changed, if desired, by means of the user-definable character function.

Colour/Graphics

We encountered no problems in tuning the television into the colour 'test-card' picture which the TI portrays on the screen when first switched on. Colour was clear and definition sharp, except for a few combinations of colours which gave rise to rather 'vague' borders.



Disk Controller – shown here with one drive....

The whole screen is normally cyan (pale blue), changing to green while a program is actually running (a novel, but rather useful trick) – though it can easily be switched to any other of the sixteen colours on the TI's

TEXAS

palette. Any of the characters can be positioned on the screen with its own (foreground) colour – together with a background colour covering the small square behind the character.

Though there are no high-resolution plotting functions, as such, the TI allows the user to redefine any of the standard characters, as well as create his own special graphics characters for games or scientific symbols.

TI enhanced BASIC, however, provides colour graphics functions that are quite incredible – similar and in some ways superior to Atari's player-missile graphics. The programmer may define a number of 'sprites' – objects of any shape and colour that may be given speeds and moved around the screen at will.

Sixteen different levels of priority may be specified so that sprites can move in front of or behind each other, and there are specific functions to detect collisions or 'coincidences', in other words a crash or a score.

Sound

A large variety of sounds from melodious to cacophonous can be produced through the T.V. speaker – including synthesised speech if you purchase the appropriate peripheral for £99.

The effects are easy to produce, even for the beginner, by means of the SOUND command in BASIC. Duration, together with the frequency and volume specifiers for up to three components can be specified – in other words, up to three-part harmonies are possible.

In addition, a noise component can be specified – varying from a high-pitched whistle to a headache-inducing throb – all designed to assist in the production of explosions, zoomsplats and aliens dying excrutiating deaths.

Don't let this put you off – a little bit of programming and you can reproduce some quite acceptable chamber music.

TI market a cartridge pack called Music Maker in which actual notes (semi quavers, crotchets and the like) can be edited on the screen, played and stored on cassette tape or disk.

Editing

In *"Which Home Computer?"* in our February edition, the TI99/4A showed consistently high in most departments, and as this report demonstrates, our in-depth evaluation supports this. One marking, however, we would like to downrate somewhat after many hours of usage – for program editing.

Though editing controls exist – and it is therefore possible to modify any section of a program by inserting, deleting or overwriting characters, it is necessary to specify the lines you wish to alter, rather than move the cursor direct to the error. To be fair, the TI method only looks poor when compared to the excellent full-screen editing found on Commodore's PET and VIC models.

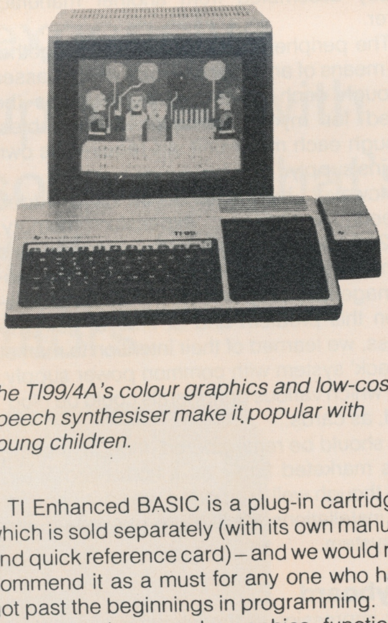
Sadly, the TI editing bears rather more resemblance to the kind of line editing found on BASIC's written for use with teletypes and early terminals, and indeed Texas Instrument's background in minicomputers may have been influential.

BASIC

Texas have opted for their own version of BASIC, rather than the most standard – Microsoft – implementation. On balance, the advantages of this decision seem to outweigh the disadvantages.

Under the latter heading we must place the scarcity of string handling functions (LEFT$ and RIGHT$ for example) found in most BASICs, and the fact that TI BASIC is rather pedantic about where you place spaces in your expressions (which most others aren't). However, generally speaking, TI BASIC is remarkably compatible with Microsoft – much more so than many other versions, anyway – and you should have little difficulty in converting program listings to run.

The advantages are mainly additional commands designed to help the new programmer. They include Toolkit-like functions for program development and debugging, as well as special commands for coping with sound, colour, graphic drawing and the optional joysticks. Many of the latter must be preceded by a CALL statement which seems a trifle unnecessary, though may have been incorporated with future expansion in mind.



The TI99/4A's colour graphics and low-cost speech synthesiser make it popular with young children.

TI Enhanced BASIC is a plug-in cartridge which is sold separately (with its own manual and quick reference card) – and we would recommend it as a must for any one who has got past the beginnings in programming.

Besides the superb graphics functions mentioned earlier, there are also some sophisticated facilities for accepting/validating data from the keyboard, and formatting results on the screen.

Documentation

This is of a high standard – consistent with TI's reputation for calculator manuals. A handy: "Read This First" leaflet explains how to set up the computer and check that all is in order.

"Beginner's BASIC" provides an introduction to some of the simpler ideas in BASIC programming for the complete beginner. The reader is shown how to create simple colour and sound effects early on – which is encouraging.

In addition to this book, comes the Users Reference Guide, which gives a detailed description of each command, with a handy reference at the front. At the end of the book are a number of sample programs to type in, glossary and one or two reference tables.

There is a distinct lack of any system information for the enthusiast, such as memory maps, or system level routines. This information would be fairly irrelevant, anyway, since there are no PEEK, POKE and SYS equivalents for penetrating the BASIC operating system. But it does confirm that TI intend their machine for the beginner or person who uses pre-packaged software, rather than the enthusiastic programmer.

The two books together do not provide a full course in programming. One is for the newcomer, the other is for those who know BASIC. If you wish to progress beyond the first, you will really need to purchase a separate book on programming.

Game Controls

The TI99/4A permits two joysticks (or Wired Controllers as TI refer to them) to be connected for purposes of playing games or moving objects around the screen in educational programs. We found the units to be well constructed and convenient to use – though many of our 'guinea pigs' said they preferred the more chunky designs of Atari and Commodore.

The joysticks were of the eight position variety, rather than permitting an infinity of different positions.

There is no provision on the Texas for game peddles or a light pen for pointing to answers directly on the screen, which is a pity.

Plug-in programs

This has to be one of the strong points for the TI – the quality and range of Solid State Software putting it at least on a par with Atari.

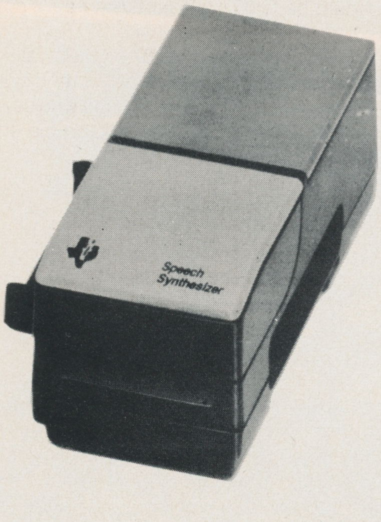
As mentioned earlier, the mounting/loading arrangements and physical construction of the cartridge system are far more satisfactory than most. Inserting a new cartridge while the machine has switched on caused the system to reset to its 'front page' – a kind of test card showing all the colours and the TI logo. Pressing any key showed the menu: Press 1 for TI BASIC, 2 for Space Invaders, etc – whatever the new cartridge contained.

TI publish a catalogue of software titles, showing what is available on cassette, disk or cartridge, and what ancilliary equipment is needed to run them.

All the more popular packages are sold in cartridge form, though we would make the point that several are very expensive, costing up to £40.

Although TI have made use of a number of software companies on both sides of the Atlantic, development has clearly been under central control. The result is that all the packages have a pleasing consistency in packaging, documentation, and the use of specific keys for moving objects, changing options and replaying games.

Secondly, because most packages were specifically developed for TI, they make full use of the colour, graphics and sound facilities. In a few cases, we felt, the designs had gone overboard, assaulting the senses and nerves with a barrage of sound and colour. TI claim, however, that all of their programs have gone through extensive user opinion testing first. This may be well and good for Space Invaders, but the last thing you want in a quiet game of chess are assorted pips and squeaks on a lurid green background!



Speech Synthesiser – for budding Daleks....

The range of software falls into four categories: Home Management, Education/ Personal Enrichment (!), Entertainment, and Other Applications (which includes a number of professional libraries – developed, presumably, from TI's programmable calculator applications packs). The Home Management titles were candidly described by TI's marketing manager as "The packages you need to have available on a micro but which aren't going to be of interest to the majority of users."

The Education series is superb in presentation – covering subjects such as Beginning Grammar and Physical Fitness. However, there has to be a fundamental flaw in Pre-School Early Learning Fun, which teaches the alphabet and numbers 1 to 9 yet requires the student to read instructions and use a keyboard (including such functions as Enter).

Entertainment scores highly, too, with all the old favorites such as Hunt the Wumpus, A-Maze-ing and even Oldies but Goodies I and II. Many contained that elusive quality of addictiveness – with some refreshing humour: Space Invaders may be specified as Merely Aggressive or Downright Nasty, for example.

Though the range of games is not as extensive as Atari's, and the amount of quality software marketed by independent suppliers is marginal, TI's catalogue of software is definitely a plus point for the machine.

Cassette

The TI can control two cassette recorders – one as both record and playback, and one for playback alone. This means that it is possible to store reasonable amounts of data on a cassette and update information by reading from one unit, making modifications and writing to the other.

Leads were supplied to connect to the earphone and microphone mini-jackplug sockets of an ordinary cassette deck. We experienced no trouble setting up – though if your cassette doesn't have jackplug sockets, you will need to purchase a conversion cable from any Hi-Fi shop; this wasn't explained in the manual.

Programs can be saved onto cassette using the SAVE command in BASIC, and retrieved using OLD instead of the more usual LOAD. The whole process is well prompted and controlled on the screen for beginners, though once you have got the hang of it, the repeated checking may get a little tiresome.

Conclusions

The TI 99/4A is a well-designed machine, and supported by a good range of off-the-shelf software. Peripherals are well designed but expensive. They are, however, all *available* should you wish to expand the machine into a professional or development system. It is aimed at the new generation of home computer *users* and as such is unlikely to be favoured well by the older *enthusiasts.*

The TI's main competitors are the VIC, BBC A, and Atari 400. Though less of a 'convivial' machine than the VIC, it outclasses it on facilities and construction. The Atari has more software and high-resolution graphics as standard, but costs more and lacks a proper keyboard.

So perhaps the most interesting comparison is between the TI and BBC – currently the same price. On the one hand (BBC) you have an incredible specification and large user-following, but with only promises for peripherals and software, and construction clearly a low-priority consideration. On the other, you have a machine built like a tank, well supported from day one, but designed to keep the enthusiast at bay.

Likes

* Good colour
* User definable character set
* High quality sound
* BASIC with commands for Colour and Sound etc.
* Enhanced BASIC option with Sprite Graphics
* Range and quality of software
* Convenience of plug-in cartridge feature
* Solid construction
* Good documentation

Dislikes

* Separate power supply *and* UHF Modulator
* Limited number of keys
* Program Editing
* Some software very expensive
* Screen width limited to 28 characters for text
* No access to machine code without expansion

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Solid State Printer

Thermal printer (requires special paper)....

Technical Notes

The TI99/4A is based on the 16-bit TMS9900 microprocessor, though to the BASIC programmer, this appears no different to any 8-bit chip. The basic machine comprises 26K ROM and 16K RAM. Plug-in cartridges can add up to 36K of ROM, and a further 32K of RAM can be added externally.

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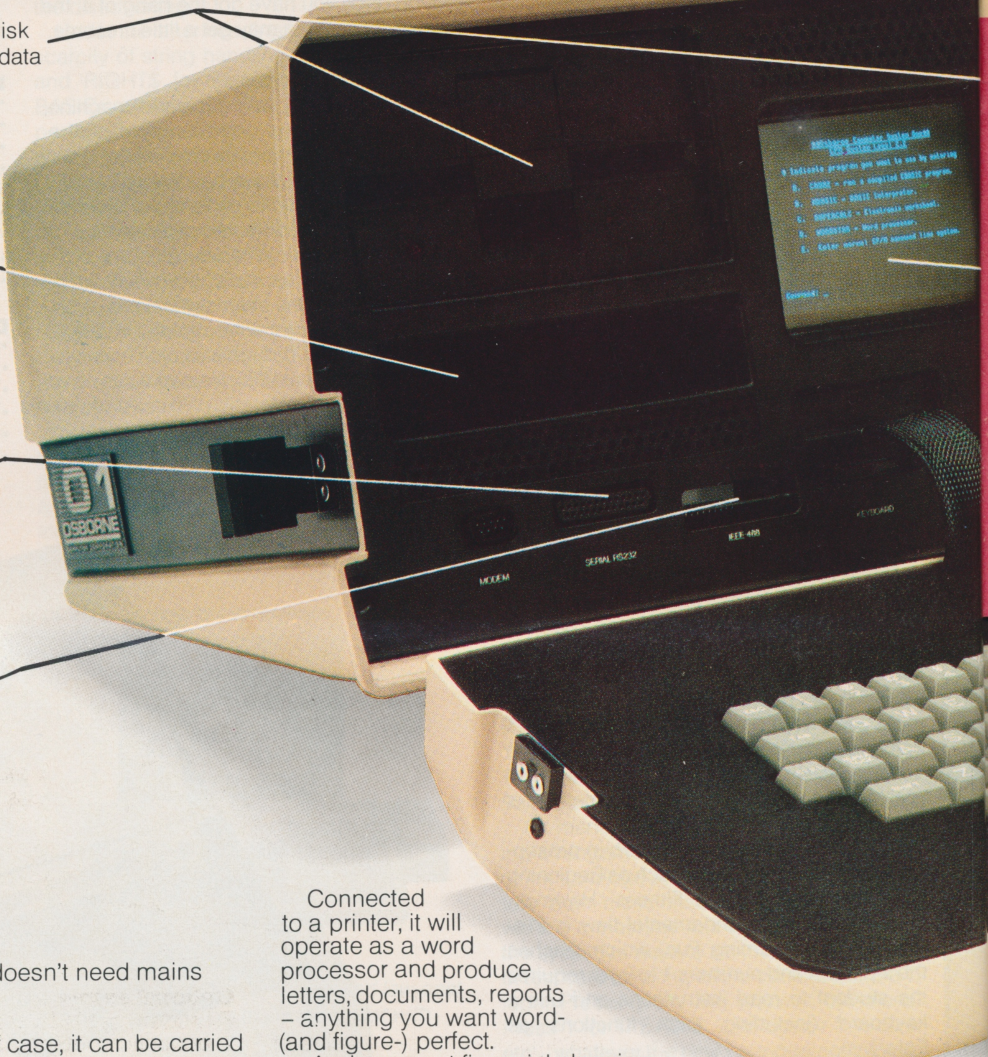
Dual floppy disk drives. Two 5¼" floppy disk drives provide 100,000 characters each of data storage, or about 60 pages of typed, doublespaced text.

Diskette storage. The floppy diskettes can be removed, providing infinite permanent information storage. Two compartments provide storage for up to 25 diskettes.

RS-232C Interface. Enables the OSBORNE 1 to connect with serial printers, or other devices using this popular industry-standard interface.

IEEE 488 Interface. Connects the OSBORNE 1 to the standard instrumentation bus, for data communication with test instruments.



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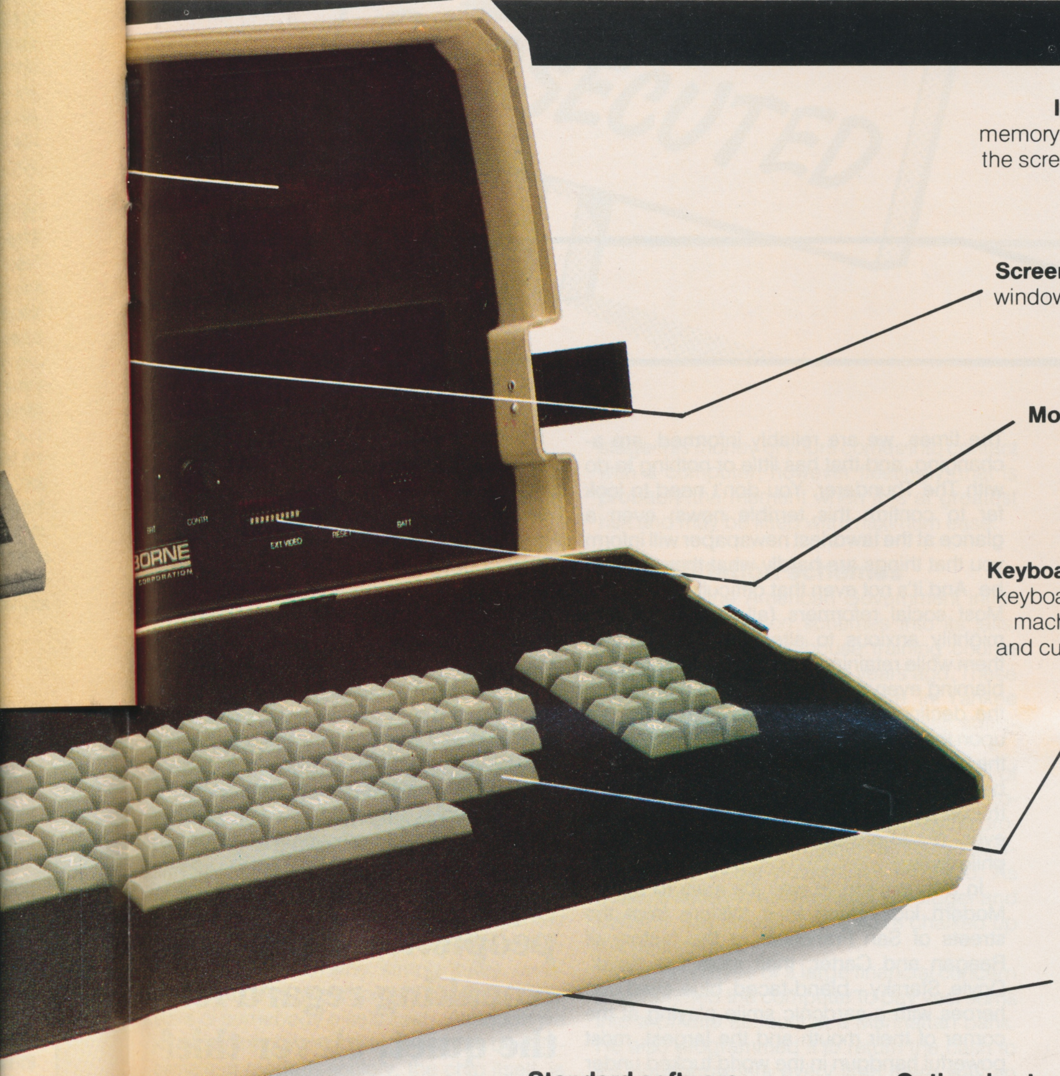

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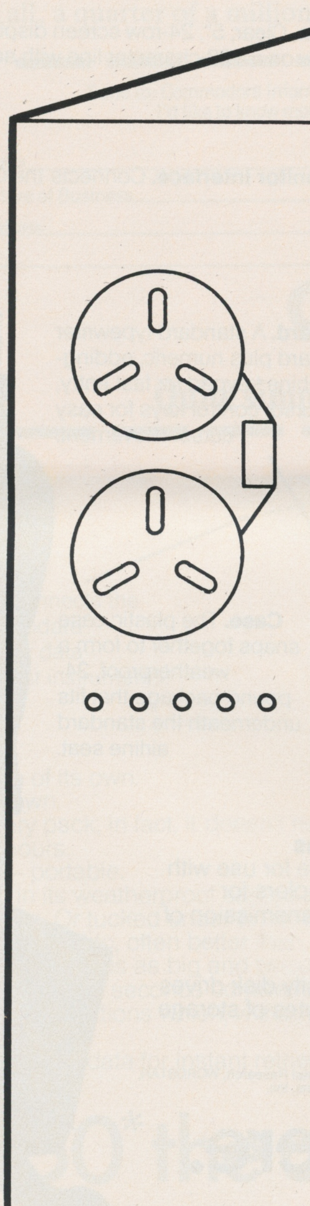
Richard Nichols on undetectable crimes – committed using computers.



The times, we are reliably informed, are a-changing, and that has little or nothing to do with The Thunderer. You don't need to look far to confirm this terrible news; even a glance at the tawdriest newspaper will inform you that things are hardly what they used to be. And it's not even that difficult to see why. Most social reformers (all of whom seem mightily anxious to alter everyone around them while retaining their own status quo) are blaming everything from the summer riots to the decline in membership of the Brownies upon that Mephistopheles of split-level living, the box. Parked in the corner of every child's bedroom, the haunted fishtank is allegedly the perpetrator of more social evils than was ever dreamed of in Dennis Wheatley's philosophy.

In a funny sort of way it's easy to agree. Modern kids glean their folklore from the streets of San Francisco or the factory of Reagan and Carter; their idols are Kojak, Doyle, Starsky – bland-faced, blue-eyed pop heroes with a sardonic smile playing at the corner of their mouth and the largest, most powerful handgun in the world tucked under their arm. God only knows how Dan Tanner scratches his left ear....

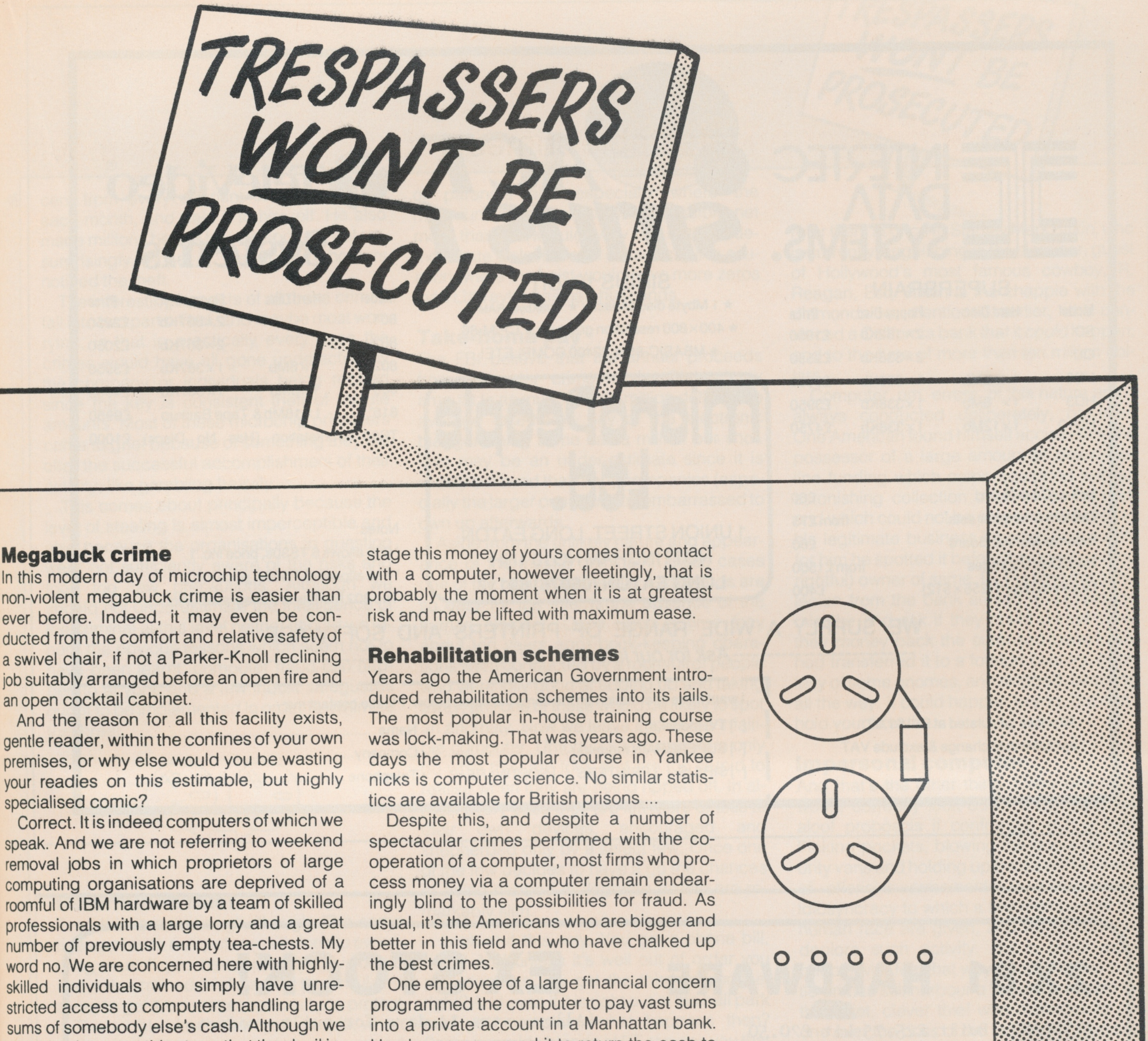
Robin Hood

When I was a lad we didn't have a box. Baird was hardly out of his cradle. Amusement came from books, then, and our heroes were Janet and John, the estimable and excellent Winnie-the-Pooh, and later, as we grew up, even Biggles, or Robin Hood. And he was always the odd one out, that Robin. Quite aside from the fact that anyone dressed in green tights, with a feather in his hat, plus a marked proclivity for hanging about in the woods with a bunch of avowedly merry men is demonstrably unusual. Robin Hood, though, alone of all the heroes we were brought up on was a criminal. Or in modern parlance, a blagger. He'd sneak out of Sherwood Forest, slip into Nottingham, singe the Sherriff's beard, help himself to the Bishop of Hereford's gold bullion and then pop back into the woods to dine on the King's deer and carouse the night away with his mates, and possibly Maid Marion, if you ignore the rumours.

This activity was presented to our naive and youthful innocence as being in some way creditable, principally because he nicked stuff from people who had lots of it and gave it to people who had little or none. Consequently we are ingrained with the belief that although your average stair dancer, lifting transistor radios and Parker biros from ex-BSC employees on the dole, is a dastardly swine, anyone who is dissatisfied with the Inland Revenue and various other government agencies and may wish to speed up the process whereby wealth is redistributed is quite entitled to do so. Generally via a passing amount of public-spirited, and therefore commendable, brigandry. To wit, R. Biggs and friends who turned over HMG to the tune of two million and became heroes overnight. In short, anyone who hits a large organisation possessed, in the normal, unwholesome run of life, of a great deal of mazuma and then shares it with his unemployed and erstwhile pauper friends is doing a rather clever thing, if not actually performing the sort of good deed which will gain him automatic entry into the Kingdom of Heaven.

> **"a great many people..... harbour a sneaking regard for the quiet, clever thief who manages to put one over the boss of the big corporation and his impersonal computer..."**

Always providing, of course, that no innocent bystander or inoffensive employee of aforesaid monolithic corporation gets topped in the process. In other words, sawn-offs are a no-no.



Megabuck crime

In this modern day of microchip technology non-violent megabuck crime is easier than ever before. Indeed, it may even be conducted from the comfort and relative safety of a swivel chair, if not a Parker-Knoll reclining job suitably arranged before an open fire and an open cocktail cabinet.

And the reason for all this facility exists, gentle reader, within the confines of your own premises, or why else would you be wasting your readies on this estimable, but highly specialised comic?

Correct. It is indeed computers of which we speak. And we are not referring to weekend removal jobs in which proprietors of large computing organisations are deprived of a roomful of IBM hardware by a team of skilled professionals with a large lorry and a great number of previously empty tea-chests. My word no. We are concerned here with highly-skilled individuals who simply have unrestricted access to computers handling large sums of somebody else's cash. Although we should point out at this stage that the devil incarnate of modern society, the chip itself, is not without a certain value.

Regard, if you will, the smallest fingernail on your hand. Conservatively value it at fifty quid. Then work out what a full lorry load of similar-sized fingernails is worth. £1.5 million wouldn't be too far out, if you're at all interested. And that is almost exactly the value of a consignment of untraceable chips which went missing not so long ago in that part of California known to locals as Silicon Chip Valley, for reasons which ought to be obvious. Chips, say our transatlantic cousins, are as negotiable as dollar bills, which makes possession of a great number of them even more attractive than possession of a great number of pound notes.

Which brings you back to money.

It's funny stuff, cash. Be advised that if you possess a lot of it, and like having a lot of it, you are not alone. The world is full of people who would all like a lot of it, and in many cases the money these other people would like to possess is yours. If you have it in sufficient quantity these other people will soon discover a way to estrange you. And if at any stage this money of yours comes into contact with a computer, however fleetingly, that is probably the moment when it is at greatest risk and may be lifted with maximum ease.

Rehabilitation schemes

Years ago the American Government introduced rehabilitation schemes into its jails. The most popular in-house training course was lock-making. That was years ago. These days the most popular course in Yankee nicks is computer science. No similar statistics are available for British prisons ...

Despite this, and despite a number of spectacular crimes performed with the co-operation of a computer, most firms who process money via a computer remain endearingly blind to the possibilities for fraud. As usual, it's the Americans who are bigger and better in this field and who have chalked up the best crimes.

One employee of a large financial concern programmed the computer to pay vast sums into a private account in a Manhattan bank. He also programmed it to return the cash to it's rightful owners every time there was an audit. All he stole was the interest while the loot was in his account. He was eventually, and accidentally brought to book, as it were, because he was betting on the gee-gees to the tune of fifteen thousand pounds. Every day...

Another smart guy lifted several million dollars and turned it into diamonds. He was caught trying to fence more than three million pounds-worth of legitimately purchased ice...

Another chappie, with a friend fronting a legitimate savings account, had it away on his toes with almost two million nicker...

Dormant accounts

Yet another simply milked dormant bank accounts. All banks are riddled with these; the account-holder has died, moved or just forgotten about his or her account. Individually they're worth nothing. Most of them don't hold more than £50, generally a lot less. Collectively they amount to millions, and the advantage is that there's no irate customer to complain. One whizz-kid creamed a quarter of a

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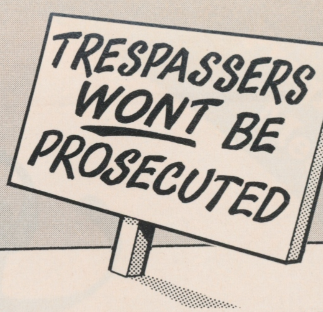
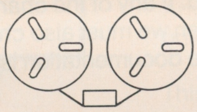


cent from every account in the computer each month, and paid it to himself. He also made millions before he was spotted, but unsurprisingly, none of the account-holders noticed the theft.

The interesting aspects of all these crimes fall into two parts. First, and maybe most worrying, is that in practically every case the crimes would have all gone undetected by the company or individuals being robbed since the key is consistent theft of minute amounts. Most of these microchip privateers came to grief because of something they did after the successful accomplishment of their activity, like gambling heavily.

This comes about principally because the level of stealing is almost imperceptible and also because the organisations in question were not sufficiently aware of the risks and took too few precautions. Although we should not underestimate the intelligence of the criminal at this level neither should we ignore the obvious lessons which seem not to have been learnt; computer fraud can happen to anyone and a few inbuilt safeguards ought to be implemented in order to minimise the threat.



Determined thief

Even this is not enough, though. The same rule applies to computers as it does to everything else. If you have something valuable and a determined thief wants it then he'll find a way to get it, no matter how well you protect it. The trouble here is that most people, when confronted with the prospect of a determined thief, still conjure up the image of a rather ugly thug in black mask, stripey jersey and toting a sack marked 'swag' over his shoulder. They have difficulty looking along a line of freshly-scrubbed graduates earnestly slaving over a hot desk and seeing them as anything other than innocent baboons fit possibly for management fodder and precious little else.

The very idea that any one of these baby-faced pinstripe jobs might do for thieving what the Beatles did for Liverpool is entirely beyond their grasp. Yet this is regrettably the case. Let's face it, Crippen, at a midget five feet and a gnats wossname tall, hardly looked like a mass murderer. He looked like any other respectable gent. Like you or I, say. Blimey, you might even *be* Crippen for all I know. Or, and I have it on the highest authority that this is far more likely to be the case, *you* may be the thieving toad who's been depriving me of ¼p every month for the last ten years.

Yes, it's a regrettable truism that while most department stores and other concerns which handle large sums of money in cash take stringent precautions against being ripped off by their own employees, even to the point of paranoia and especially where the maximum inside job couldn't possibly net more than a few quid, very few of them demonstrate a similar level of sagacity in a situation where the heist would have more zeros than Liz Taylor has had husbands.

Take-home pay

The FBI believe that the annual proceeds from computer crime in the States may amount to as much as 300 million dollars; the average take-home pay of the electronic blagger being some half a million per shot. This may be an under-estimate since it is widely believed that many companies (especially the larger ones) are too embarrassed to own up afterwards.

Aside from the unlikely nature and appearance of the master criminal in these cases one of the main reasons that such frauds are so easy for the thief is the absence of the human element. Once upon a time (say about ten years ago) book-keeping operations were conducted by a roomfull of people who were jolly good at adding up and taking away; any one of these would be likely to spot an anomaly. Now we leave it all to the infallible computer. Unfortunately computers only do what they are told, and are too stupid to realise when they are being ripped off. In almost every case they are left more or less to their own devices, encouraged and shepherded only by a select few. Once one of the few decides to have a go the chances of being nabbed *in flagrante delicto* are remarkably slim.

Look at it this way. You get a phone bill, right? And unless it's well out of order you pay, soon as you get the third red notice, right? And even if it is right out of the ball park and you complain, what happens then? Some peroxide blonde at BT assures you that the bill is done on the computer and therefore can't be wrong, so naff off. And if you press your case, what happens then? They get the meter checked, find it's operating perfectly and suggest you stop prevaricating and cough up. Your doctor assures you that kneecaps are absolutely essential to the art of walking, so you pay, right? But suppose it was wrong? Suppose some smart ice-cream in the BT office has done a number on the computer and it's bumping up bills? The meter on the exchange is working fine. How often do they (or anyone else who sends out computer-originated bills) check up to see if the punters are being taken for a ride? A penny on every phone bill would be worth having, would it not?

Silly bill

Checking the computer is the last thing that anyone ever thinks of. But next time you get a silly bill *you'll* think twice, won't you? Bet the Gas Board don't. It's their computer, after all.

By now proprietors of Phone companies, Gas and Electricty Boards and Water Authorities all over the country will be throwing up their hands in horror, all agog to explain why it couldn't possibly happen. Permit me to refer them at once to Stanley Mark Rifkin, who is currently languishing in the slammer, guest of Hollywood's most famous cowboy, R. Reagan, Esq. Rifkin is the chappie with the diamonds we mentioned earlier, who convinced a California bank that it *could* happen, and to the tune of more than ten million dollars...

Computer, um, errors, of this nature aren't always conducted deliberately, however. One American found himself accidentally the possessor of a large amount of below-the-line funding which came equipped with an astonishing collection of zeros at the end, and which could not be properly attributed to his legitimate business income. Fortunately for him he spotted it before the previous (and rightful) owner of same. By the time the gentlemen from the bank arrived to explain the mistake and ask if they could please have their money back the surprised beneficiary had transferred it to a foreign country, courtesy of some gnomes, and skipped, laughing all the way. It could happen to you, but don't hold your breath...

Impersonal computer

And that's the other thing. Every one of us would correctly look down a dignified and aloof proboscis if confronted with a thief. Picking pockets, blowing the doors off security vans and holding up banks with a variety of offensive armaments is a regrettable idiosyncracy to which a few members of the human race are given, and we all correctly deplore such activity. But a great many people who feel that way about the less subtle crimes still harbour a sneaking regard for the quiet, clever thief who manages to put one over the boss of the big corporation and his impersonal computer without lifting a finger in anger or stirring from his chair. Most of us honestly believe that large companies can afford to lose the odd million here and there. Indeed there are many who think they deserve to get done from time to time.

The fact is that a genuine feeling in this country persists, based on the belief that if you earn more than five thousand a year and don't work on the Ford production line, then you're a filthy capitalist swine and ought to be relieved of the burden of your ill-gotten gains as soon as possible. Preferably by some form of modern-day Robin Hood with flowing locks and a sardonic smile of some kind, perhaps with a cigarette clenched between his teeth and a devil-may-care sneer at the doctor who has just predicted his imminent demise from an unknown wasting disease caused by slaving unsocial hours in less than salubrious conditions for an uncaring minion of a large corporation.

That's just our generation. Kids today, watching the box, weaned on Harold Robbins and similar from age three onwards, what will they be up to...?

Program D

Documentation is really the key to good programming, and yet is often the area given least attention. Chris Preston explains why it is so important and shows you how to pick up some 'good habits'.

Documentation is a very grey area in the working lives of most programmers. It is lumped with "washing the car" and "going to the dentist" in the list of things which ought to be done but tend to get put off as long as possible. As always though, the putting off only makes things worse, because once you have left a program for a few weeks or longer, the exact logic behind that cunning routine in line 2460 has faded from your mind, so that when something goes wrong you are left scratching your head and wondering how on earth it was supposed to work in the first place!

Documentation in one form or other is really the secret of good programming. By "good programming" I do not mean the ability to write a particular routine which takes less memory than anybody else's or runs so much faster. "Good programming", like "good behaviour" is something that must be acquired, but is difficult to teach. You will find that getting into the habit of writing full documentation for everything you code, far from wasting time, it can make life an awful lot easier.

So what does documentation involve? Documentation starts as soon as you have decided that you are going to write a program. There are several distinct phases that can be identified, as follows:

1. **Planning Stage.** We must write down what we want the program to do: what data we are going to give it; what outputs we want; and what processing is involved. The program should be broken down into sections, and each section described separately, with a "master plan" describing how the sections relate to each other.

2. **Program design.** We next design the program. This does not mean we sit down at the machine and start typing. Each of the sections we identified in the planning stage should be written on paper first and "bench tested", that is, going through the program manually with a paper and pencil, asking ourselves at each stage, *"What will the program do here?"; "Will the IF statement in line 1200 cause a jump?"; "Is this bit doing what I really want it to do?"* As well as showing up many mistakes, this process helps us to fix details of the program in our minds, so that when the thing falls down when we first run it (and this is inevitable!), we can say, "Ah yes, I am not calling subroutine 15000", instead of "Why is there nothing in A$? I wonder where I set that up?" Any potential problems which show up should be dealt with now; like bad pennies they will not go away. Remember Murphy's Law: If something can go wrong it will, and at the worst possible moment. Do not wait until the worst possible moment arrives: sort it out now.

3. **Testing Phase.** Once the program has been keyed in, it must be thoroughly tested. Any doubts we had in stage two about a particular part of the program should be put to good use by concentrating on that part of the program. Try to make it blow up. Key in ridiculous values. If the program collapses and you have to re-write a routine, be glad! That is one less bug! During the testing phase, the program is bound to be hacked around. If any of the changes affect the structure of the program then we must also change the documentation. Out-of-date documentation is almost as bad as none at all.

What form should this documentation take? Well there are various forms used depending on which stage of program writing we are at. In stage 1, the specification may still be somewhat nebulous and probably changing quite frequently, so we want our documentation to be easily alterable, too. When I first start to write a program, I make three lists. The first is "Program Inputs", which may be values from a disk file, or a keyboard or something exotic like another computer. For each input you should make a guess as to how long each item will be, say 30 characters for a name field, and a range of values, 0 to 5 for a numeric field. Complementary to the input list is a "Program Outputs" list. This gives, in fairly broad terms, what outputs we require from the program, either on the screen or printer, or going to another disk file. Again, field sizes and ranges of values should be included.

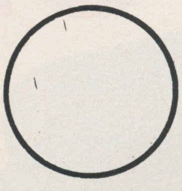
The last (and I mean the *last* list – this should wait until we have decided what the inputs and outputs are going to be) is the "Process List". This describes what the program is going to do with each of the inputs and how it is going to derive each of the outputs. When you write this list, you should be thinking ahead to the program itself, and put the list into a logical order, starting with reading the inputs, and then going on the calculation and output phases.

Flowcharts

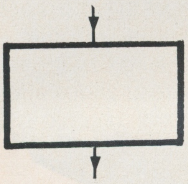
The next stage is a little more formal, as this is where we define exactly how the program is going to run. The easiest

Documentation

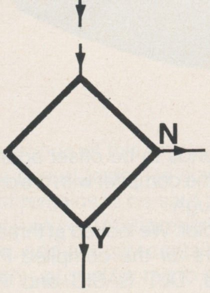
method of describing program flow is by means of flowcharts. There is a certain amount of awe surrounding flowcharts but there is really nothing to them at all. Flowchart templates are easy to obtain and not expensive, or you can draw them freehand if you are not too fussy on how pretty they look! There is unfortunately no standard for flowcharts, but the four symbols I use are fairly widespread:



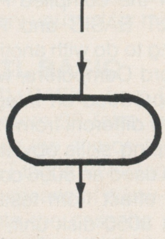
At the top of the flowchart, this symbol gives the routine a name. At the bottom of a flowchart, it acts like a BASIC "GOTO" statement, to allow you to jump to another routine, or in the case of a subroutine, this acts as a RETURN statement.



This is the basic 'action' box. Any activities should be put into one of these boxes.



This is a 'decision' box, corresponding to a BASIC IF...GOTO statement. It does not matter whether the side or the bottom branch is the 'yes' branch, this should be organised to make the diagram easier to read. Always label both branches though, it makes it easier to spot mistakes!



This box corresponds to a BASIC 'GOSUB' statement, and is used to call a routine on another flowchart diagram somewhere.

As an example of flowcharting, Diagram 1 is a chart showing my procedure for getting up in the morning. *(As this is supposed to be a family magazine, this particular flowchart has had to be heavily modified – Ed)*

Layouts

Going hand in hand with the flowchart are screen and printer layouts, and file formats. Screen and printer layouts are best drawn on graph paper of a reasonable size and really do save a lot of time if you are doing a complex report. No more hunting through line after line of BASIC counting SPC's and TAB's wondering how far across the page you are and whether there is room for that extra field. Drawing your layouts beforehand also allows you to experiment before you actually write the code, and hopefully get a more balanced, easier to read layout. Planning file layouts also saves a lot of time when it comes to writing the program. Instead of having to remember whereabouts each field in the record starts, you can just look it up. You can also plan file sizes much more easily.

A typical file layout might be:

Field Name	Length	Start	End
Car Make	20	1	20
Model	20	21	40
Engine Size	4	41	45
Colour	1	46	47

Notice that the colour field is only 1 character long. You can often save disk space if you have an alphanumeric field with a small number of possible values (red, blue, white, black, say) by using a shorter code to represent the values e.g. 0,1,2,3. Of course, the documentation must include a table giving the corresponding colour for each code!

How detailed should the flowcharts be? A very high level flowchart would just say, "Accept inputs", "Calculate answer", "Print answer". This is not much help! A very low-level flowchart is just the same as writing the program, with one box for each BASIC statement. The ideal lies between these two extremes, and depends largely on the temperament of the individual programmer. The point is that the flowchart should help you write your program, and afterwards, it should help you remember how it works. Within these constraints, the level of detail is up to you.

Having done all our layouts and flowcharts, the actual process of writing the program should now be almost automatic. If you have to stop and work out any values such as TAB's, then your preparation has not been complete enough.

Tables

Going hand in hand with the program writing are yet more tables. You should keep a list of all variables used, and what they are for. If a variable is a code for something, such as the colour code in our example above, you should make a note of the range it is allowed to take, 1 to 7 say. If you are debugging and find that it contains 13, something is wrong. If you did not know that 13 is illegal for that variable it would be much harder to spot. Any 'special' values, such as -1, for 'unknown' should be clearly marked, because if you look up element -1 in an array or file you will get into trouble, and without your table you might sit for hours wondering why on earth that variable has got -1 in it. Worse still, you might take out the line which sets the variable to -1 thinking it was in

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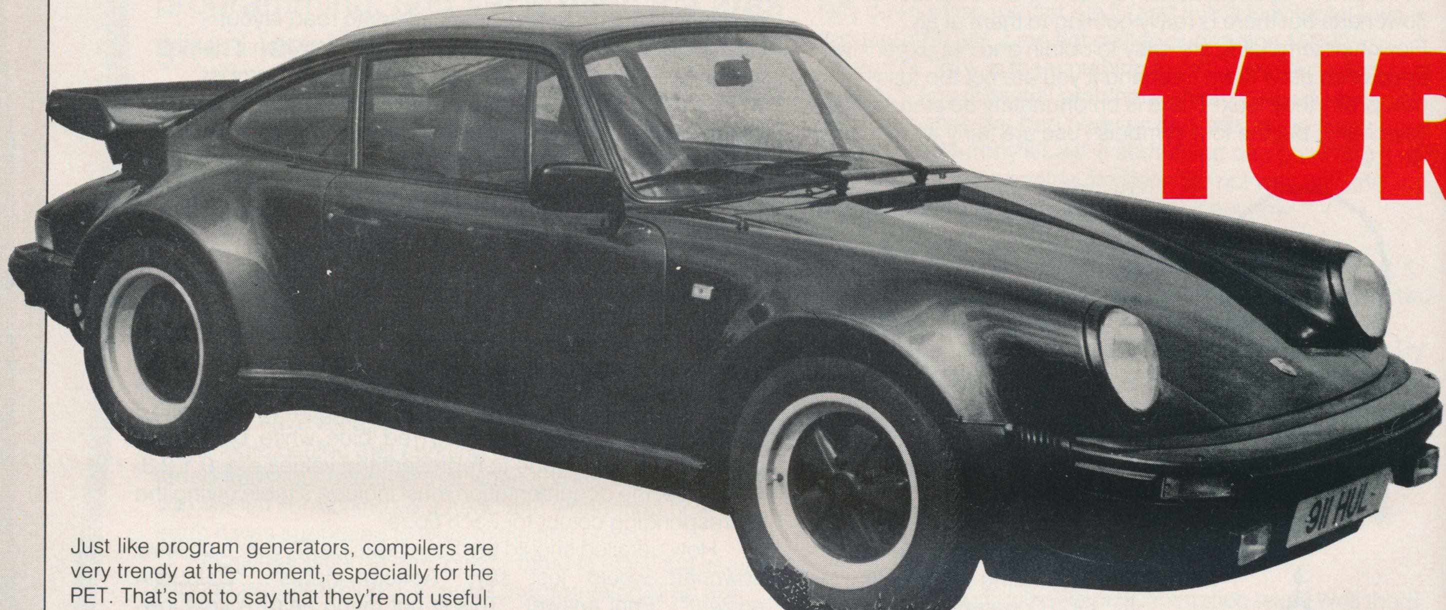
Compilers are all the rage – but are they really useful? **Peter Wood** found that efficiency, speed and program size varies considerably – but that compiled "Adventure" on a PET makes a good test!



Just like program generators, compilers are very trendy at the moment, especially for the PET. That's not to say that they're not useful, 'cos they are, but rather that there's several around on the market. Before we get into the pro's and con's (sic) of the various models available, I'll bore the experts by giving the novices an overview of what a compiler does and why. If this is old hat to you then feel free to jump on to the meatier bits.

Unfair discrimination!

My trusty old Penguin Dictionary of Microprocessors defines a compiler as *"1. A program which prepares a machine language program from instructions written in a source language."* and *"2. A harmless drudge"* (which scores another point to Penguin for having a sense of humour – I think). As many of you will be aware, programs written directly in machine code (or via an assembler) work considerably faster than those written in good old BASIC. The reason behind this seemingly unfair discrimination against people who aren't clever enough to write in hexadecimal or nmemonics (whatever they are) is as follows. Computers work in binary, and the closer your input is to binary, the less work the machine has to do converting it into something it understands and can use. This means that the actual operations can take place sooner, and hence appear to be faster. Clear? Never mind. Now when the likes of you or I key in a BASIC program, and then type RUN, the PET starts looking at the program line by line, and interpreting each and every statement into machine code as it goes along. This process is rather slow by computing standards, and can give rise to horrors like Garbage Collection (don't ask!).

The advantage is, of course, that you can alter lines, or parts of lines, at a moment's whim and run the program again straight away. Where compilers are clever is that they do all the hardwork in one go (and only once), putting the machine code out into a disk file (called an Object File) which then substitutes for the original program file you wrote (referred to as the Source File). Whenever you load and run the object file, you are really executing a machine code program, with all the benefits of speed you'd expect. The disadvantage (if it is one) is that you can't list the object file (since it's in hexadecimal) and you can't alter it, except by altering the original Source File and re-compiling it to produce a new Object File. Well, you can't have your cake and eat it!

Compatibility

There are six main areas of importance in compilers that I can think of. Firstly, accurate conversion and compatibility with the interpretive BASIC – fairly obvious, but I've heard many hair-raising tales regarding compilers that actually introduce errors (as if we didn't put enough in ourselves!). It also helps if you don't have to spend hours re-writing the program you wanted to compile just to suit the compiler.

Secondly, good error reporting – if you have made a mistake, it certainly helps if the compiler can at least equal the PET's interpreter in terms of reporting the fact to you (e.g. ? SYNTAX ERROR).

Thirdly, speed of operation of the compiled program – most people will compile to achieve greater speed (although others may require non-listable programs, for instance).

Fourthly, speed of compilation – it's not much good if you have a thousand line program and the compiler runs at 3 lines an hour, is it? One of my earlier incarnations was at a famous U.K. airport, where I worked on reservation systems (nothing to do with Indians) on minicomputers. We cut out one of those anti-smoking Government Health Warning adverts from the paper (with a skeleton holding a cigarette – remember that one?) and added the title "Waiting for the compiler to finish". Need I say more?

Fifthly, size of object file – it's not much use having an object file that won't load into your computer through lack of memory space! Since compilers have to allocate room for variables at compile time (unlike the interpreter which merrily does it as it needs to), compiled programs may often be longer than their interpretive sources (although not always – more about this later on).

Lastly (whew) extra commands and statements – since we are effectively buying another language for the machine, why not reach for the moon and expect some extra functions as well. Some give 'em to you, others don't. This tends to be offset against the compatibility of the compiler with the original PET BASIC, though.

Well, back to the plot. We looked at three of the main contenders for the compiled PET market – Petspeed, DLT BASIC and PC-BASIC (which has nothing to do with another micro publication!) Oxford Computers, who market Petspeed, also produce an Integer Compiler (one that is fairly different from PET BASIC), but time and typing skills obviated an in-depth look at it. We used an 8096 computer (to get maximum effect from testing large programs) and an 8050 disk unit, although I believe versions of all these exist for most PETs capable of using a disk unit.

PC-BASIC

PC-BASIC uses a security ROM to prevent pirating which, rather unfortunately for us, uses the same slot as the WordPro ROM. However, a Philips screwdriver and my Apple (!) chip removing tool soon took care of that. It is necessary to buy extra copies of this chip (at £25 each), if you want the compiled program to run on another machine. Once the compiler has been loaded, the program disk may be removed and replaced with the diskette containing the program to be compiled. You are then invited to enter the source filename, object filename and printer type. Once all three options have been entered, everything else happens automatically and you can go and make the tea (assuming that

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RBOCHARGING *your* PROGRAMS

it's a long program). The current pass and line number are displayed as the compilation takes place. If you have a printer connected, an error report is printed, followed by the program size, the variable size and the total size in bytes. The program was very simple to use, although when typing in the file names it was all too easy to use cursor left and cursor right, which produced the "quotes mode" graphics rather than moving the cursor, which was rather annoying.

The version of PC-BASIC we had for review couldn't use the extra memory of the 96k machine, and was not compatible with System 96 (see below). There are a number of extra statements which may be included in the source program, but these fall outside of the scope of this article. I have tabulated all the speed tests, file sizes and so on, so all that remains to be said here is that the manual was very comprehensive and easy to follow, and actually contained a detailed index (very unusual for micro software!).

DTL BASIC

DTL BASIC, from Dataview, can run under System 96 (also from Dataview), which allows the source and object to use the 96k PET to full advantage. Anti-rip-off is provided by means of a key-ring dongle, which plugs onto the cassette port. In order to use the compiler with System 96, it is necessary to fit one dongle, load and run System 96, remove the first dongle and fit the compiler dongle and then load and run the compiler. This can become rather frustrating after a few runs, but may not be a problem assuming that this is only performed once a day. A third dongle, labelled RUN TIME is also provided, which if fitted to the second (internal) cassette port, will allow programs compiled on the compiling machine to run on any other PET fitted with this run time dongle inside. These can be purchased separately as with the PC-BASIC chip.

On start-up, you are invited to enter the name of the source and object files, followed by three questions relating to printing, which result in a full source listing, error reports and size of the compiled program and variables. If a run has been performed before on the disk in drive one then the last filenames used will be displayed, and may be accepted by one keystroke. Again the program was very simple to use, and the compilation was entirely automatic, with the pass number and current line number being displayed at the top left of the screen. Several extra statements are allowed for the more advanced programmer. The manual was clearly written, but lacked an index.

Petspeed

Petspeed was the simplest of all to operate; all you have to do after loading the program is enter the source program name. It apparently used as much memory as it wanted, and compiled *Adventure* ran happily on the 8096 without any special software. The object file has the same names as the source with a (witty) suffix of "gt". Unfortunately for those who would like an automatic listing, the program does not have any print options during compilation, although a Report program is provided which can be run to produce a list of all variable names and their locations, together with a system memory map of the object. Copyright protection is achieved with one of the new stackable dongles on the cassette port, but unlike its competitors, the compiled program can be run on any suitable PET without any form of extra device (which has tremendous advantages for programmers wishing to speed up their own products without installing dongles or chips on their clients' machines).

Petspeed produces "Speedcode" which is a pseudo-code, rather than straight 6502 machine code. The Speedcode interpreter is attached to the object automatically at compilation time, and is transparent to the user. Whilst this means that there is always an overhead of 32 blocks on each object file, the speed of execution seems to be greatly enhanced. The manual was very brief, but gave all the necessary information to use the program effectively and rather appealed to my simple nature! No index was included, but with only twelve pages it was hardly necessary. The excellent execution speed and "dongle-less" object files made Petspeed my personal favourite.

We used five different programs to test the compilers for accuracy, speed of compilation, size of object file and speed of execution.

Program 1 – Commodore's Disk Performance Test (mainly disk I/O)

Program 2 – Adventure (Jim Butterfield version)

Our thanks to Porsche Cars Great Britain Ltd. for supplying the photograph of a Porsche 911 Turbo.

Program 3 – Simple print to the screen program:-

```
 5  TI$="000000"
10  FOR I = 1 TO 10
20  FOR J = 1 TO 2000
30  PRINT CHR$(I+64);
40  NEXT J
50  NEXT I
60  PRINT TI$
70  END
```

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PETSPEED

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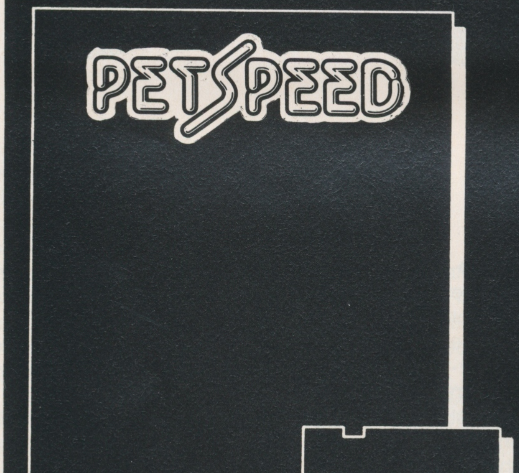

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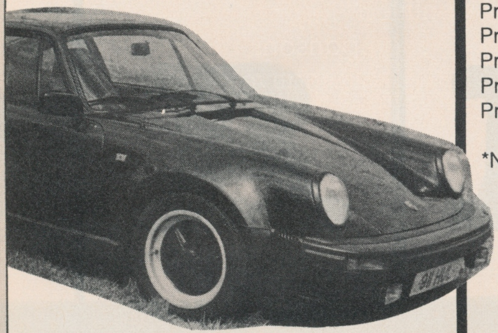


Program 4 – Simple poke to the screen program:-

```
 5   TI$="000000"
10   FOR I = 1 TO 10
20   FOR J = 1 TO 80
30   POKE 32768+(I*80)+(J-1).I
40   NEXT J
50   NEXT I
60   PRINT TI$
70   END
```

Program 5 – Simple array and data program:-

```
  5  TI$="000000"
 10  DIM A$(999),B%(999).C(999)
 20  FOR I = 1 TO 999
 30  READ X$: IF X$="END" THEN RESTORE
 35  A$(I) = X$
 40  B%(I) = I
 50  C(I) = I * RND(-1)
 60  PRINT I
 70  NEXT I
 80  PRINT TI$
 90  END
100  DATA "A","B","C"."D"."E"."F"."G"."H"."I"."J"."K"."END"
```

Tables 1, 2, 3 and 4 show the results obtained from our tests.

Table 1 – Compilation times

	DTL BASIC		PC-BASIC		PETSPEED	
	Min	Sec	Min	Sec	Min	Sec
Program 1	1	41	0	35	2	30
Program 2	10	00	*Note	1	3	06
Program 3	0	27	0	23	1	40
Program 4	0	27	0	23	1	38
Program 5	0	33	0	23	1	57

*Note 1 – PC-BASIC gave an "out of memory" error as it could not use more than 32k of RAM.

Table 2 – Object sizes (in blocks)

	Original	DTL BASIC	PC-BASIC	PETSPEED
Program 1	11	8	15	42
Program 2	49	35	n/a	86
Program 3	1	1	3	35
Program 4	1	1	3	35
Program 5	1	1	n/a	75

Table 3 – Run times

	Original		DTL-BASIC		PC-BASIC		PETSPEED	
	Min	Sec	Min	Sec	Min	Sec	Min	Sec
Program 1	1	39	7	39	7	23	*Note 2	
Program 2 (a)	0	26	0	26	n/a		0	16
Program 2 (b)	0	23	0	8	n/a		0	4
Program 3	2	25	2	33	0	51	0	33
Program 4	0	14	0	7	0	2	0	3
Program 5	0	36	0	28	n/a		0	9

Note – we tested *Adventure* both (a) setting up and (b) giving the first set of instructions, both of which involve many calculations and disk access.

*Note 2 – Petspeed gave a "string too long" error when program 1 was run.

Table 4 – Percentage improvement run times

	DTL BASIC	PC-BASIC	PETSPEED
Program 1	0	8	n/a
Program 2 (a)	0	n/a	43
Program 2 (b)	65	n/a	83
Program 3	0	65	77
Program 4	50	86	79
Program 5	22	n/a	75

DTL BASIC was the only program successfully to compile all the programs with no hiccups and no changes, and produced the smallest object files.

PC-BASIC managed only half of the programs with no changes, but was very quick on compilation time and fastest in execution on program 4.

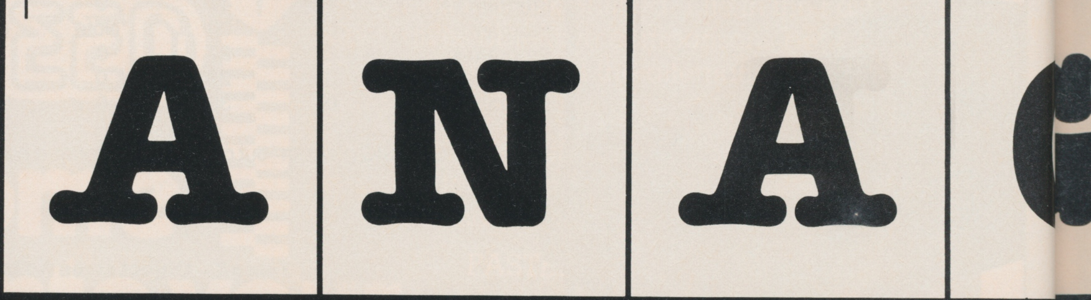
PC-BASIC: £300 plus VAT from Intex Datalog Ltd. (0642 781193)

DTL-BASIC: £360 plus VAT from Dataview Limited (0206 865835)

Petspeed: £240 plus VAT from Oxford Computer Systems (Software) Ltd. (0865 49597)

System 96: £245 plus VAT from Dataview (or £100 if purchased with a compiler)

Oxford Integer Compiler: £165 plus VAT from Oxford Computers (Petspeed is also available together with the Oxford Compiler for £320 plus VAT)



A sophisticated and intelligent BASIC program that will help you play Scrabble and solve The Times Crossword!

Anagram Cracker is a program designed to help crossword addicts (and any other word addicts) solve anagrams with minimum brain damage. It uses a form of artificial intelligence to suppress as many unlikely solutions as possible although there is a risk of throwing the baby out with the bath water. In any event, the user can have every possible combination of the letters displayed, the use of the intelligence feature being optional.

The intelligence is based on 6 main features:-

1. Unlikely endings
2. Unlikely beginnings
3. Unlikely two-letter combinations
4. Three consecutive letters containing no vowel or Y. This is a useful facility but does carry a certain amount of risk: for example, SCRATCH would be suppressed by this routine.
5. One, two or three letter words not in the "common" list.
6. Fixed positions for letters and spaces.

Of the above, routine 5 would only be used where there was more than one word. Routine 6 is the only one used in the non-intelligent phase.

The program commences by asking whether the intelligence feature is to be used. If not, the program will only use the all-combinations, non-intelligent phase of the program. The user is asked to enter the anagram to be solved. If this is more than one word, the entry must contain the spaces that divide the final words. For example, if the anagram is UFDEP and the answer is two words, three and two letters respectively, then the entry should be UFD EP (the actual order of the letters is irrelevant).

The user is then given the opportunity to enter any known fixed positions of letters. In the example above, if it was known that the second letter of the first word was E, the user would enter it when asked what the second letter was. Spaces are ignored for this purpose and an asterisk typed for any unknown position.

If the intelligence feature has been selected, the program will proceed to create various lookup tables, taking about 90 seconds for 7 letters and longer for lengthier anagrams. The letters are then cycled through a shuffling loop which produces a new combination on each pass. Any fixed letters or spaces are excluded from this. Having obtained a new combination, the letters are examined by the intelligence routines (if selected, otherwise the combination is printed out with fixed letters and spaces re-inserted).

By Bob Chappell

The anagram is suppressed if:-

a) It has an unlikely beginning
b) It has an unlikely ending
c) It contains an unlikely combination of letters
d) It has 3 consecutive letters which contains neither a vowel or Y.
e) It has a 1,2 or 3 letter word which is not in the common list.

Suppression causes the anagram to be displayed as asterisks (this is merely to indicate that the program is still chugging along and hasn't hung up somewhere). If the anagram is not suppressed, any fixed letters or spaces are re-inserted and the anagram displayed. The program formats the anagrams to a convenient number per line and a convenient number of lines per screen. When the screen is full, the user is given an opportunity to study it before allowing the program to continue. If the screen happens to contain no possible solutions, it will clear itself and continue automatically.

Having exhausted all its possibilities, the program will proceed to display every possible combination, taking into account any fixed letters or spaces. When this second phase is complete, the user will be invited to enter another anagram.

The program tends to run slowly when using the intelligence feature and naturally this varies with the length of the anagram. The non-intelligent phase is very fast. Bear in mind that a 4 letter anagram has 120 permutations while a 10 letter anagram has over 3.6 million! The program will tell you exactly how many permutations it has to make.

The letter shuffling routines at lines 65-70 and 450-535 were adapted from another program. Originally, I used a simple nested loop structure, one loop for each position in the anagram. This worked fine but was rather slow. The current routine, although not easy to understand or explain, runs much faster. The best way to learn how it works is to dry run it (that is, use a pencil and paper and take it one step at a time writing down each change in each variable as it occurs).

Another problem is that one is faced with the limit on the number of FOR – NEXT loops and GOSUBs that you can have in operation at any one time. This has meant that I have had to construct the intelligence loops without using FOR – NEXT statements, which in turn means that the program runs slower than it needs to.

The program has been written for a PET but uses no non-standard facilities (with the exception of the Clear Screen symbol, which is shown in the listing as a capital C), and so is easily convertible to any micro. Apart from the latest BASIC 4 ROM PETs, all other PETs suffer from garbage collection problems. This, too, reduces the speed at which the program runs.

The program uses some 10K. Arrays have been set at various arbitrary limits. If space is a problem, the look-up arrays can be reduced. I have set no limit checks when the loop-up arrays are being filled and a program error will result if any of these arrays overflows.

The program could be improved by refining the intelligence routines and outputting to a printer. The intelligence routines effectively cut down the number of solutions printed by some 90% or more. See if you can make it perform even more effectively.

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GRAM
CRACKER

The program does not recognise the fact that a letter can occur more than once in a word, consequently the same solution may appear at different points in the shuffle. It would be interesting to find a way to cope with this – for example, the program thinks there are 6 possible combinations of ADA (3x2x1) whereas there are really only 3.

Now try to find the anagrams of CARSTUD and HAMLYN; I'm not saying the program's quicker but my head aches a lot less!

Anagrams, as the saying goes: Lure OK!

Major Routines

Lines	Description
20-70	Letter shuffling
80-100	Replace any known spaces or letters in their fixed places
110-120	If any 1 letter words, check if 'A' or 'I'
130-155	See if any 3 consecutive letters lack vowel or Y.
165-315	Check if beginning or ending of each word in the "unlikely" lists.
325-345	Check if any letter pairs in the "unlikely combinations"
355-400	Check if any 2 or 3 letter words absent from the "common" lists.
405-440	Word printing routine.
450-535	Letter shuffling control subroutines
540-575	Obtain anagram
585-740	Remove known spaces and fixed position letters.
750-825	Create the Beginnings/Endings list by checking the anagram for any of the pairs in the Data statements
835-915	Similarly, create separate Beginnings and Endings lookups.
925-960	Similarly, create the combinations list.
980-1070	Similarly, create the 2 and 3 letter word lists.

Major Variables

BT,BS, ET,UT,N2,N3	Total entries in the look up lists for Beginnings/Endings, beginnings, endings, combinations two and three letter words respectively.
NS	Number of spaces in the anagram
SN( )	Pointers to space positions
P( )	Pointers to fixed letter positions
TP	Total fixed positions
B1$( )	Beginnings/endings list
B2$( )	Beginnings list
EL$( )	Endings list
UC$( )	Combinations list
W2$( )	Two letter words list
W3$( )	Three letter words list
W$	Current anagram string following each shuffle
CC	Column count
RC	Row count
FC	Flag showing whether Intelligence phase in operation.
L	Length of anagram after spaces and fixed letters extracted
L1	Length of anagram before spaces and fixed letters extracted.

```
5 REM **ANAGRAM CRACKER**
10 REM **BOB CHAPPELL  21/2/82**
15 GOTO1080
20 FG=FC:RC=0:CC=0:W$=Y$:L2=L1+1:S=L-1
25 IFFC=0THENPRINT"USING THE INTELLIGENCE FEATURE.
30 IFFC=1THENPRINT"PRINTING EVERY POSSIBLE COMBINATION.
35 M=0:GOSUB80
40 M=M+1:IFM<LGOTO55
45 FC=FC+1:IFFC<2THENGOSUB430:GOTO20
50 PRINT:PRINTTAB(12);"FINISHED":GOSUB430:GOTO540
55 FORC=1TOM:ONMGOSUB450,455,460,470,480,490,505,510,520:NEXT:GOTO40
60 REM **SHUFFLE LETTERS**
65 N$="":M$=RIGHT$(W$,1):FORG=STOL-TSTEP-1:N$=MID$(W$,G,1)+N$:NEXT
70 W$=LEFT$(W$,S-T)+M$+N$
```

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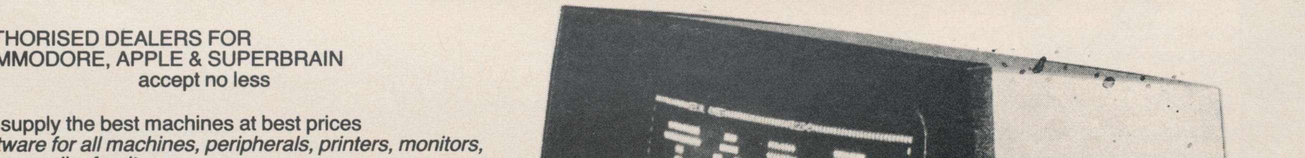

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ANAGRAM CRACKER

```
75 REM **REPLACE LETTERS**
80 N$="":IFTP=0THENN$=W$:GOTO100
85 K=1:Q=0:FORP=1TOTP
90 Q=Q+1:IFP(P)<>QTHENN$=N$+MID$(W$,K,1):K=K+1:GOTO90
95 N$=N$+P$(P):NEXT:N$=N$+MID$(W$,K)
100 L$=LEFT$(N$,2):R$=RIGHT$(N$,2):JJ=0:IFFC=1GOTO410
105 REM*1 LETTER WORDS**
110 JJ=JJ+1:IFJJ>N1THENJJ=0:GOTO130
115 L1$=MID$(N$,N1(JJ),1):IFL1$<>"A"ANDL1$<>"I"GOTO405
120 GOTO110
125 REM **VOWELS ABSENT**
130 JJ=JJ+1:IFJJ>L1-2THENJJ=0:GOTO165
135 JK=0:L1$=MID$(N$,JJ,1):M$=MID$(N$,JJ+1,1):R1$=MID$(N$,JJ+2,1)
140 IFL1$=" "ORM$=" "ORR1$=" "GOTO130
145 JK=JK+1:IFJK>6GOTO405
150 V$=V$(JK):IFL1$=V$ORM$=V$ORR1$=V$GOTO130
155 GOTO145
160 REM**UNLIKELY BEGINNINGS/ENDINGS**
165 KK=0:A1=1:IFNS=0GOTO200
170 JJ=0:KK=KK+1:IFKK>NSGOTO220
175 A2=SN(KK)-2:L1$=MID$(N$,A1,2):IFA2<1THENR1$=MID$(N$,1,2):GOTO185
180 R1$=MID$(N$,A2,2)
185 JJ=JJ+1:IFJJ>BTTHENA1=A2+3:GOTO170
190 IFL1$=B1$(JJ)ORR1$=B1$(JJ)GOTO405
195 GOTO185
200 JJ=JJ+1:IFJJ>BTTHENJJ=0:GOTO250
205 IFL$=B1$(JJ)ORR$=B1$(JJ)GOTO405
210 GOTO200
215 REM **UNLIKELY BEGINNINGS**
220 KK=0:A1=1:IFNS=0GOTO250
225 JJ=0:KK=KK+1:IFKK>NSGOTO270
230 L1$=MID$(N$,A1,2)
235 JJ=JJ+1:IFJJ>BSTHENA1=SN(KK)+1:GOTO225
240 IFL1$=B2$(JJ)GOTO405
245 GOTO235
250 JJ=JJ+1:IFJJ>BSTHENJJ=0:GOTO305
255 IFL$=B2$(JJ)GOTO405
260 GOTO250
265 REM **UNLIKELY ENDINGS**
270 KK=0:IFNS=0GOTO305
275 JJ=0:KK=KK+1:IFKK>NSGOTO325
280 IFSN(KK)<3THENL1$=MID$(N$,1,2):GOTO290
285 L1$=MID$(N$,SN(KK)-2,2)
290 JJ=JJ+1:IFJJ>ETGOTO275
295 IFL1$=EL$(JJ)GOTO405
300 GOTO290
305 JJ=JJ+1:IFJJ>ETTHENJJ=0:GOTO325
310 IFR$=EL$(JJ)GOTO405
315 GOTO305
320 REM **UNLIKELY COMBINATIONS**
325 JJ=JJ+1:IFJJ>UTTHENJJ=0:GOTO355
330 JK=0:L$=UC$(JJ)
335 JK=JK+1:IFJK>L1GOTO325
340 IFMID$(N$,JK,2)=L$GOTO405
345 GOTO335
350 REM **2 LETTER WORDS**
355 JJ=JJ+1:IFJJ>N2THENJJ=0:GOTO385
360 JK=0:L$=MID$(N$,N2(JJ),2)
365 JK=JK+1:IFJK>T2GOTO405
370 IFW2$(JK)=L$GOTO355
375 GOTO365
380 REM **3 LETTER WORDS**
385 JJ=JJ+1:IFJJ>N3THENFG=1:GOTO410
390 JK=1:L$=MID$(N$,N3(JJ),3)
395 IFW3$(JK)=L$GOTO385
400 JK=JK+1:IFJK<=W3GOTO395
405 N$=SF$
410 IFCC=0THENPRINT"}";
415 PRINTN$;"}";:CC=CC+L2:IFCC+L2<38THENRETURN
420 PRINT:CC=0:RC=RC+1:IFRC<21THENRETURN
425 RC=0:IFFG=0THENPRINT"c";:FG=FC:RETURN
430 PRINT:PRINT"      PRESS SPACE TO CONTINUE"
435 GETI$:IFI$<>" "THEN435
440 PRINT"c";:FG=FC:RETURN
445 REM **LETTER SHUFFLING LOOPS**
450 T=1:GOSUB65:RETURN
455 T=2:GOSUB65:B$=W$:T=1:GOSUB65:W$=B$:RETURN
460 T=3:GOSUB65:C$=W$:T=1:GOSUB65:FORJ=1TO2:T=2:GOSUB65:B$=W$:T=1:GOSUB65
465 W$=B$:NEXT:W$=C$:RETURN
470 T=4:GOSUB65:D$=W$:T=1:GOSUB65:GOSUB455:GOSUB455
475 GOSUB460:GOSUB460:GOSUB460:W$=D$:RETURN
480 T=5:GOSUB65:E$=W$:T=1:GOSUB65:GOSUB455:GOSUB455
485 GOSUB460:GOSUB460:GOSUB460:FORZ=1TO4:GOSUB470:NEXT:W$=E$:RETURN
490 T=6:GOSUB65:F$=W$:T=1:GOSUB65:GOSUB455:GOSUB455
495 GOSUB460:GOSUB460:GOSUB460:FORZ=1TO4:GOSUB470:NEXT
500 FORZZ=1TO5:GOSUB480:NEXT:W$=F$:RETURN
505 T=7:GOSUB65:G$=W$:GOSUB530:FORYY=1TO6:GOSUB490:NEXT:W$=G$:RETURN
510 T=8:GOSUB65:H$=W$:GOSUB530:FORYY=1TO6:GOSUB490:NEXT
515 FORH=1TO7:GOSUB505:NEXT:W$=H$:RETURN
520 T=9:GOSUB65:I$=W$:GOSUB530:FORYY=1TO6:GOSUB490:NEXT
525 FORH=1TO7:GOSUB505:NEXT:FORXX=1TO8:GOSUB510:NEXT:W$=I$:RETURN
530 T=1:GOSUB65:GOSUB455:GOSUB455:GOSUB460:GOSUB460:GOSUB460
535 FORZ=1TO4:GOSUB470:NEXT:FORZZ=1TO5:GOSUB480:NEXT:RETURN
540 PRINT"c";TAB(8);"ANAGRAM CRACKER":PRINTTAB(7)"================="
545 PRINT:PRINT"THE ANAGRAM YOU WANT TO SOLVE":PRINT:INPUT"IS";W$:L=LEN(W$)
550 IFL<4THENPRINT:PRINT"TOO EASY! YOU CAN DO THAT YOURSELF!":GOTO545
555 SF$="":FORJ=1TOL:SF$=SF$+"*":NEXT
560 NS=0:FC=CF:X$=W$:M=L:L1=L:JJ=0:PRINT:PRINT"THERE ARE";
565 M=1:J=2:FORC=2TOL:IFMID$(W$,C,1)<>" "THENM=M*J:J=J+1
570 NEXT
575 PRINTM;"COMBINATIONS."
580 REM **REMOVE KNOWN LETTERS**
585 TP=0:PRINT:PRINT"DO YOU KNOW THE POSITION OF ANY OF THE"
590 PRINT:INPUT"LETTERS (Y/N)";A$:IFA$="Y"GOTO620
595 IFA$<>"N"GOTO585
600 FORJ=1TOL
605 A$=MID$(W$,J,1):A$(J)=A$
610 IFA$=" "THENTP=TP+1:P$(TP)=A$:P(TP)=J:SN(TP)=J
615 NEXT:NS=TP:GOTO665
620 PRINT"cTYPE THE LETTER (* IF UNKNOWN) IN"
625 PRINT:PRINT"RESPONSE TO THE FOLLOWING PROMPTS:-"
630 PRINT:K=0:FORJ=1TOL
635 A$=MID$(W$,J,1):A$(J)=A$:IFA$=" "THENNS=NS+1:SN(NS)=J:GOTO655
640 K=K+1:PRINT"LETTER";K;:INPUTA$
645 IFA$="*"GOTO660
650 JJ=1
655 TP=TP+1:P$(TP)=A$:P(TP)=J
660 NEXT
665 IFTP=0THENY$=W$:GOTO725
670 REM **CHECK FIXED LETTERS ARE OK**
675 FORJ=1TOTP:P=0:T$="":FORK=1TOL
680 A$=MID$(W$,K,1):IFA$<>P$(J)THENT$=T$+A$:GOTO690
685 P=1:T$=T$+MID$(W$,K+1):K=L
690 NEXT:IFP=0THENJ=TP
695 W$=T$:NEXT
700 IFP=0THENPRINT:PRINT"LETTERS DO NOT MATCH ORIGINAL WORD.":GOTO545
705 L1=L:L=LEN(W$):IFJJ=0THENY$=W$:GOTO725
710 M=L:FORC=L-1TO1STEP-1:M=M*C:NEXT
715 PRINT:PRINT"ALLOWING FOR FIXED LETTERS,THERE ARE
720 PRINT:PRINT"NOW";M;"COMBINATIONS.":Y$=W$
725 IFL<11GOTO740
730 PRINT:PRINT"MORE THAN 10 UNKNOWN POSITIONS.":PRINT:PRINT"I CAN'T COPE!"
735 GOSUB430:GOTO540
740 GOSUB430:IFFC=1GOTO20
745 REM**BEGINNINGS/ENDINGS LIST**
750 PRINT:PRINT"PLEASE WAIT WHILE I CREATE THE":PRINT"LOOK-UP TABLES."
755 PRINT"CREATING LOOK-UP 1."
760 RESTORE:BT=0:FORJ=1TOB3:READX$(J):NEXT:FORJ=1TOB1:READL$:FORJJ=1TOB3
765 R$=X$(JJ):FORJK=1TOL1-1:IFA$(JK)=R$GOTO785
770 IFA$(JK)<>L$THENNEXTJK,JJ,J:GOTO795
775 FORKK=JK+1TOL1:IFA$(KK)=R$THENKK=L1:BT=BT+1:B1$(BT)=L$+R$
780 NEXTKK:JK=L1:NEXTJK,JJ,J:GOTO795
785 FORKK=JK+1TOL1:IFA$(KK)=L$THENKK=L1:BT=BT+1:B1$(BT)=L$+R$
790 NEXTKK:JK=L1:NEXTJK,JJ,J
795 FORJJ=1TOB2:READN$:L$=LEFT$(N$,1):R$=RIGHT$(N$,1)
800 FORJK=1TOL1-1:IFA$(JK)=R$GOTO820
805 IFA$(JK)<>L$THENNEXTJK,JJ:GOTO835
810 FORKK=JK+1TOL1:IFA$(KK)=R$THENKK=L1:BT=BT+1:B1$(BT)=N$
815 NEXTKK:JK=L1:NEXTJK,JJ:GOTO835
820 FORKK=JK+1TOL1:IFA$(KK)=L$THENKK=L1:BT=BT+1:B1$(BT)=N$
825 NEXTKK:JK=L1:NEXTJK,JJ
830 REM**BEGINNINGS LIST**
835 PRINT"CREATING LOOK-UP 2."
840 BS=0:FORJJ=1TOB4:READN$:L$=LEFT$(N$,1):R$=RIGHT$(N$,1)
845 FORJK=1TOL1-1:IFA$(JK)=R$GOTO865
850 IFA$(JK)<>L$THENNEXTJK,JJ:GOTO880
855 FORKK=JK+1TOL1:IFA$(KK)=R$THENKK=L1:BS=BS+1:B2$(BS)=N$
860 NEXTKK:JK=L1:NEXTJK,JJ:GOTO880
865 FORKK=JK+1TOL1:IFA$(KK)=L$THENKK=L1:BS=BS+1:B2$(BS)=N$
870 NEXTKK:JK=L1:NEXTJK,JJ
875 REM**ENDINGS LIST**
880 PRINT"CREATING LOOK-UP 3."
885 ET=0:FORJJ=1TOTE:READN$:L$=LEFT$(N$,1):R$=RIGHT$(N$,1)
890 FORJK=1TOL1-1:IFA$(JK)=R$GOTO910
895 IFA$(JK)<>L$THENNEXTJK,JJ:GOTO925
900 FORKK=JK+1TOL1:IFA$(KK)=R$THENKK=L1:ET=ET+1:EL$(ET)=N$
905 NEXTKK:JK=L1:NEXTJK,JJ:GOTO925
910 FORKK=JK+1TOL1:IFA$(KK)=L$THENKK=L1:ET=ET+1:EL$(ET)=N$
915 NEXTKK:JK=L1:NEXTJK,JJ
920 REM**UNLIKELY LIST**
925 PRINT"CREATING LOOK-UP 4."
930 UT=0:FORJJ=1TOTU:READN$:L$=LEFT$(N$,1):R$=RIGHT$(N$,1)
935 FORJK=1TOL1-1:IFA$(JK)=R$GOTO955
940 IFA$(JK)<>L$THENNEXTJK,JJ:GOTO970
945 FORKK=JK+1TOL1:IFA$(KK)=R$THENKK=L1:UT=UT+1:UC$(UT)=N$
950 NEXTKK:JK=L1:NEXTJK,JJ:GOTO970
955 FORKK=JK+1TOL1:IFA$(KK)=L$THENKK=L1:UT=UT+1:UC$(UT)=N$
960 NEXTKK:JK=L1:NEXTJK,JJ
965 REM **VOWELS**
970 FORJ=1TO6:READV$(J):NEXT
975 REM**2 LETTER WORDS**
980 IFNS=0THENPRINT"c";:GOTO20
985 PRINT"CREATING LOOK-UP 5.":N2=0:NS=NS+1:SN(NS)=L1+1:K=1:FORJ=1TONS
990 IFSN(J)-K=2THENN2=N2+1:N2(N2)=K
995 K=SN(J)+1:NEXT:IFN2=0THENFORJJ=1TOW2:READN$:NEXT:GOTO1040
1000 T2=0:FORJJ=1TOW2:READN$:L$=LEFT$(N$,1):R$=RIGHT$(N$,1)
1005 FORJK=1TOL1-1:IFA$(JK)=R$GOTO1025
1010 IFA$(JK)<>L$THENNEXTJK,JJ:GOTO1040
1015 FORKK=JK+1TOL1:IFA$(KK)=R$THENKK=L1:T2=T2+1:W2$(T2)=N$
1020 NEXTKK:JK=L1:NEXTJK,JJ
1025 FORKK=JK+1TOL1:IFA$(KK)=L$THENKK=L1:T2=T2+1:W2$(T2)=N$
1030 NEXTKK:JK=L1:NEXTJK,JJ
1035 REM**1 LETTER WORDS**
1040 N1=0:K=1:FORJ=1TONS:IFSN(J)-K=1THENN1=N1+1:N1(N1)=K
1045 K=SN(J)+1:NEXT
1050 REM**3 LETTER WORDS**
1055 N3=0:K=1:FORJ=1TONS
1060 IFSN(J)-K=3THENN3=N3+1:N3(N3)=K
1065 K=SN(J)+1:NEXT
1070 FORJ=1TOW3:READW3$(J):NEXT:PRINT"c";:GOTO20
1075 REM **INITIALISE**
1080 J=0:JJ=0:JK=0:K=0:KK=0:FC=0:CC=0:M=0:C=0:G=0:TS=0:L=0:L1=0:L2=0:S=0:T=0
1085 Q=0:P=0:TE=0:ET=0:TP=0:TU=0:UT=0:RC=0:BS=0:B1=0:B2=0:B3=0:Z=0:BT=0:SF=0
1090 FG=0:N1=0:N2=0:N3=0:T2=0:NS=0:CF=0:ZZ=0:YY=0:H=0:XX=0:W2=0:W3=0:A1=0:A2=0
1095 W$="":X$="":Y$="":M$="":T$="":N$="":L$="":R$="":ST$="":L1$="":L2$=""
1100 A$="":B$="":C$="":D$="":E$="":F$="":G$="":H$="":I$=""
1105 DIMP$(20),P(20),SN(10),N1(5),N2(5),TN(10),N3(5),A$(30)
1110 PRINT"c";TAB(8);"ANAGRAM CRACKER":PRINTTAB(7)"================="
1115 PRINT:PRINT"DO YOU WANT TO USE THE"
1120 PRINT:INPUT"INTELLIGENCE FEATURE (Y/N)";A$:IFA$="N"THENCF=1:GOTO540
1125 IFA$<>"Y"GOTO1115
1130 REM **UNLIKELY BEGINNINGS/ENDINGS**
1135 LM=80:B1=16:B2=98:B3=12:DIMB1$(LM),X$(B1)
1140 DATAB,C,D,G,J,M,P,Q,V,W,X,Z
1145 DATAB,C,D,F,G,H,J,K,P,Q,T,V,W,X,Y,Z
1150 REM **MORE UNLIKELY BEGINNINGS/ENDINGS**
1155 DATAMC,MD,MG,MH,MJ,ML,MM,MQ,MR,MT,MV,MW,MZ,RC,RG,RJ,RQ,RV,RW,RZ,BK,KU,TN
1160 DATADK,FK,GK,HK,PK,TK,YK,ZK,HS,XS,BT,DT,GT,KT,XN,TL,XL,YL,ZL,LC,LJ,LG,LR
1165 DATATT,WT,XT,YT,ZT,BF,DF,GF,HF,KF,MF,PF,SF,TF,WF,XF,YF,ZF,LV,KL,LW,UV,SV
1170 DATANB,NC,NF,NH,NJ,NL,NM,NN,NP,NQ,NR,NV,NW,NX,NZ,KA,LX,BN,FN,CN,DN,HN
1175 DATAYR,SB,SG,SJ,SR,SZ,SD
1180 REM **MORE UNLIKELY BEGINNINGS**
1185 B4=58:DIMB2$(B4)
1190 DATAMB,MN,MP,MS,RB,RD,RF,RK,RL,RM,RN,RP,RS,RT,AK,CK,EK,LK,OK,BS,DS,FS,UE
1195 DATAGS,LS,MS,NS,RS,TS,YS,CT,FT,LT,NT,PT,RT,FF,LF,LM,LP,NK,KS
1200 DATALN,RN,WN,WK,WL,WS,WV,DL,HL,LL,LB,LD,UI,ND,NG,HT
1205 REM  **MORE UNLIKELY ENDINGS**
1210 TE=150:DIMEL$(LM)
1215 DATABA,CA,DA,FA,GA,HA,JA,NA,OA,PA,VA,WA,XA,YA,ZA,BH,DH,FH,IH,JH,KH,LH
1220 DATARH,WH,XH,YH,ZH,BL,CL,DL,FL,GL,HL,PL,SL,KI,LI,MI,NI,PI,RI,SI,TI,VI,PN
1225 DATABR,CR,DR,FR,GR,HR,JR,KR,PR,TR,VR,WR,XR,BU,CU,DU,FU,YI,UI,AI,EI,SQ
1230 DATAGU,HU,JU,LU,MU,NU,PU,QU,RU,SU,TU,OO,VU,WU,XU,YU,ZU,SW,SN,WV,AC,OI
1235 DATAAF,AQ,AV,EB,EC,EG,EH,EI,EJ,EQ,EU,EV,EZ,IB,IF,IG,IQ,IU,IV,IW,FN,LI,BI
1240 DATAOC,OG,OJ,OQ,OV,OZ,UC,UF,UJ,UK,UW,UZ,YI,BO,CO,DO,FO,CI,DI,FI
1245 DATAGO,HO,JO,KO,NO,PO,RO,SO,TO,UO,VO,WO,XO,YO,ZO,GI,HI,JI
1250 REM **UNLIKELY COMBINATIONS**
1255 TU=109:DIMUC$(LM)
1260 DATAAA,AE,AO,BJ,BQ,BX,BZ,CB,CD,CF,CG,CJ,CP,CS,CW,CX,CZ,DX,FX,HH,II,IK,IW
1265 DATAIY,JB,JC,JD,JF,JG,JJ,JK,JL,JM,JN,JP,JQ,JR,JS,JT,JV,JW,JX,JZ,KK,KX,LH
1270 DATAMK,MX,PX,QA,QB,QC,QD,QE,QF,QG,QH,QI,QJ,QK,QL,QM,QN,QO,QP,QQ,QR,LZ
1275 DATAQS,QT,QV,QW,QX,QY,QZ,RX,SX,TX,UH,UK,UQ,UU,VB,VC,VD,VF,VG,VH,VJ,VK,VL
1280 DATAVM,VN,VP,VQ,VR,VS,VT,VV,VW,VX,VZ,WQ,WX,WZ,XK,XQ,XZ,YZ
1285 REM **VOWELS**
1290 DIMV$(6)
1295 DATAA,E,I,O,U,Y
1300 REM**2 LETTER WORDS**
1305 W2=24:DIMW2$(W2)
1310 DATAAM,AN,AS,AT,BE,BY,DO,GO,HE,IF,IN,IS,IT,ME,MY,NO,OF,ON,OR,SO,TO,UP
1315 DATAUS,WE
1320 REM**3 LETTER WORDS**
1325 W3=30:DIMW3$(W3)
1330 DATATHE,AND.FOR,WAS,HIS,NOT,BUT,YOU,ARE,HER,HAD,ALL,SHE,HAS,HIM,ONE,WHO
1335 DATAMAY,ITS,OUT,OUR,MAN,NOW,ANY,CAN,OLD,NEW,OWN,YET,TWO
1340 GOTO540
```

THE ENERGY CRISIS SIMULATION

Concluding our series on simulation games that are both educational and fun. **Humphrey Walwyn** explains how to play *Energesic* and publishes the program listing to run on your microcomputer.

In last month's article, I described the outline and design of an Energy game for a number of players 'armed' with a computer. I said I'd go away and write a program for it and – of course – construct myself a proper board (a more artistic version of the layout that appeared in the last issue), and play it several times. That I have now done and give my results – along with the listing – in this month's edition.

In brief, ENERGIESIC is a game about solving Britain's energy crisis over the next 100 years. Players represent banks with large amounts to invest in all types of energy sources and developments. The calculations are part fact and part estimation after many an hour spent pouring over official figures in public libraries. I shall describe the game and the exact rules a bit later but first let me turn my attention to the computer program. It's written in PET BASIC and should work on any PET with a minimum of 16K RAM and operating in upper case/graphics mode.

With reference to the *MicroComputer Printout* series on 'How to translate BASIC' (Dec 81 to Feb 82) it should be possible to convert the listing to run on most other microcomputers, since the program has been specifically written with machine compatibilityin mind. The main thing to watch out for is the screen handling controls – a key to the programmed cursor functions appears at the end.

There are lots of things that can be added on to it to make it more complex but I've tried it out several times now and it seems to work very reasonably as it stands!

Variables list

There are 12 basic energy sources (0-11) and the index is always J.

There are 21 moves (0-20) each representing a time span of 5 years and some of the arrays include a running record of each value if you want to put in graphs and things later. Here the index is always K.

The arrays are as follows...

R1(11)	Known and proven reserves in MTCE (Million Tons of Coal Equivalent)
R2(11)	Economically recoverable reserves in MTCE
C1(11)	Maximum possible capacity of developed source per year in MTCE
C2(11)	Probable normal capacity of source for best economic return (MTCE)
P(11,20)	Current production capacity per year (MTCE)
S(11)	Millions of pounds probably needed to start a new energy source
X(11)	Development costs per new MTCE in millions of pounds
O(11)	Running costs per MTCE in production, in millions of pounds
V(11,20)	Share value in millions of pounds
N$(11)	Energy name
I(11,20)	% of share capital invested in each source.
D(20)	The date (from 1980 to 2080)
E(20)	The total energy requirements in MTCE for the UK each year.
EV(20)	Current value of energy to suppliers in millions of pounds per MTCE

There are a number of straight variables used. To save on memory space, several of them have different uses at different times but I'll mention the following:

Z9	If =1 then game ends.
NN	The number of nuclear accidents to date (either Fission or Fusion)
P	Increased capacity
EX	Excess investment
EP	Energy production
ND	New discovery share price inflator
XX	If =1 then extra capacity.

Program breakdown

Lines	
10-130	Dimensions of arrays and read DATA
140-310	DATA
500-560	Main program chain to link all main sub-routines
2000-2030	Investment and capacity display
2500-2580	Investment input source by source
3000-3520	Initial energy calculation to see what Government will do.
4000-4600	Calculation of all details source by source and display
6000-6460	Nuclear disaster possibility
10000-10020	'Press any key' delay
10100	Draw a line
10200-10235	Extra costs due to large fall off in production
10300-10390	All round increase in energy production costs.

10400-10430	Boost in share price for undeveloped sources
10500-10540	Source shut down due to lack of reserves
15000-15080	END OF GAME if total produced does not match requirements.

Requirements

1 Playing board (construct from diagram in last issue).
1 Computer placed on the same table as board with VDU easily visible to all.
A set of 'poker chips' or counters for money with denominations varying from 1 to 500 million pounds.
A set of different coloured counters or beads – around thirty for each player. (These are the share board markers.)
And a set of 12 government takeover markers – one for each source.

Money

The total sum that can be in circulation by all players at the start of the game is 4000 million pounds. Divide this equally between the players.

Object

To make more money than anyone else (sensible!). This might NOT mean making the UK self-sufficient in Energy so you will have to be careful.... Money equals the cash you have in your hand plus the value of your shares on the marker board.

Number of players

1-8. With a one player game, it's simply a survival exercise!

Game theory

Players invest every five years in as many of the energy sources that they can afford. No more than fifty per cent (5 counters) can be invested in any one energy source by any one player. The computer is then informed of the total investment in each source (NOT who has invested in what) and may decide to invest itself in any source to maintain current energy requirements.

Profits, increased capacity and development are then calculated and the news displayed on the screen. Basically, the more money invested the greater the turnover and – perhaps – increases all round.

A general energy surplus may result in a fall in energy prices with sometimes disastrous effects. A shortfall in supplies may make the price rise, and profits and capacity jump accordingly. The fluctuation of energy prices is therefore very important since no player has direct control over this.

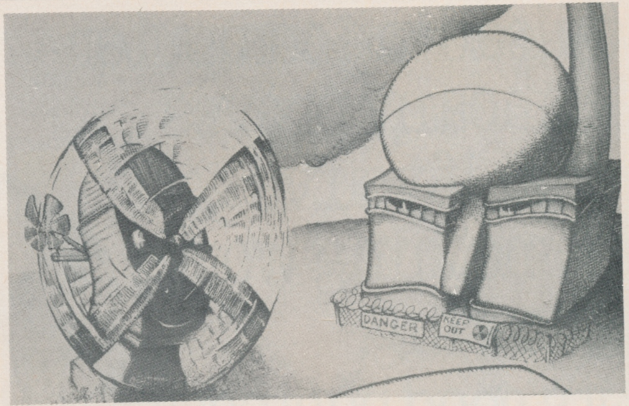
If at any time, the shortfall in energy requirements is too large, the computer will terminate the game with anarchy and breakdown the result.

It is really a matter of seeing when to get out of something and into something else. Some of the alternative energy sources don't have a high maximum capacity so you can make a quick financial killing but not solve the energy crisis in general.

How to play

(1) Set up board, computer and distribute money and share counters. Load and run program.
(2) The initial display (VALUES PER 10% SHARE) will tell you how much it costs to invest or sell any share. One player should really act as 'computer button presser' and banker.

In the first go, all players invest and pay to the banker accordingly any or all of their monies. Place the player's share counters on the board. From the second go onwards, there will be counters already on the board. Each go consists of two phases. FIRST comes the selling phase and all players cash in any shares they like. Remove all relevant counters and move the remaining counters down so there are no gaps. SECONDLY, when they have finished, it's the investment phase and all players may buy up shares again in anything they like. These two phases may NOT be mixed up. No more than 50% (5 counters) may be invested by any player in any one source at any time.



(3) Follow the screen instructions and the computer will ask for an investment input for each source. Intput total % of shares invested.
(4) The computer will then work out what the government wishes to take over to safeguard the National interest. It can take several 'key presses' for the final decision to be made (Government indecision!). Place a Government share marker on the energy source if it is taken over. This is for all the player's general information. The more investment, the greater your chances of success so it's good news to be taken over!
(5) The computer then displays a complex series of facts and information and news. Obey instructions where applicable.

Eventually it will finish the roundup of news and display a 'Government shares sold back' message. Remove all Government share markers. Every five years there is an option for private investors – that's you – to put money in. And, if the UK is still functioning (!), five years are added and you go back to (2).

Have fun.

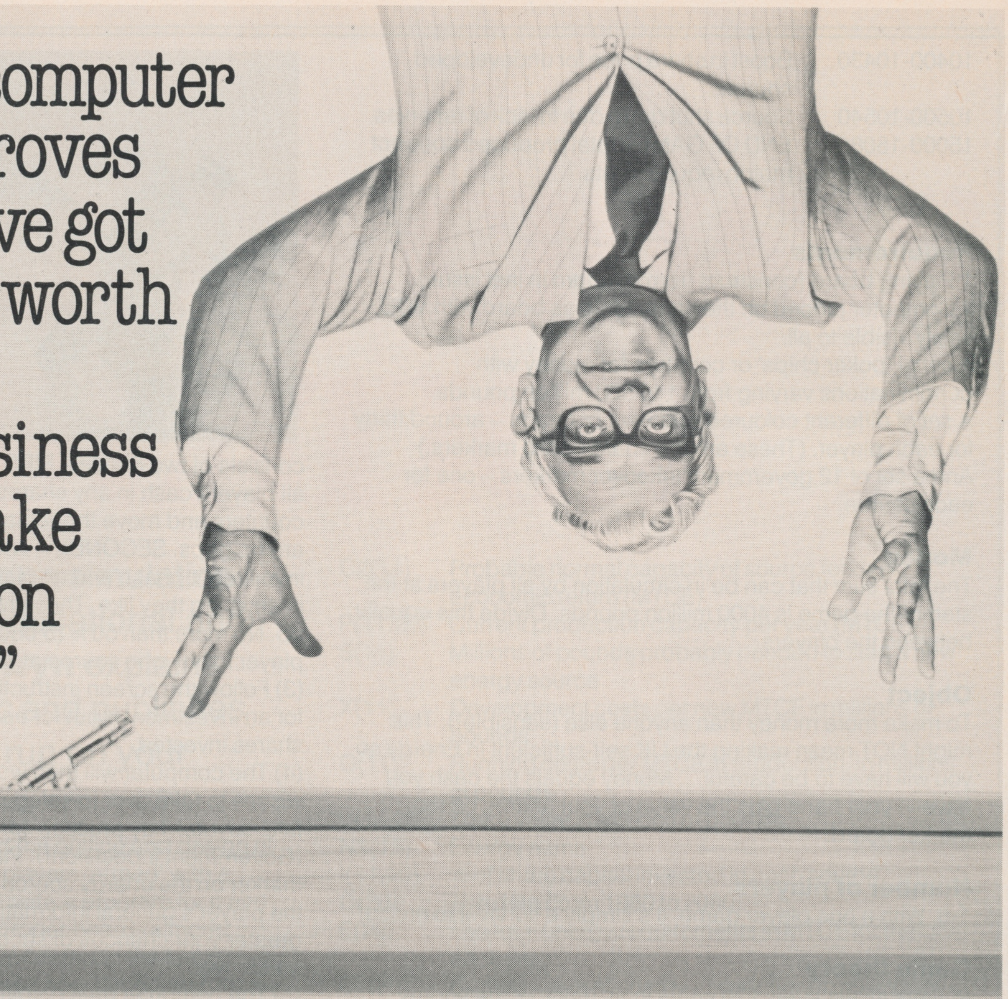
Advice

Look at the main display (2) carefully each go. Look at the board and decide if there is likely to be an energy surplus or deficit and invest accordingly. Investments in Coal, Oil and Gas are expensive but they are the main sources of return in the next twenty years or so. Coal will last even longer. Beware of nuclear disasters. You can't stop them, but Fission can be a steady money earner. Get into Tidal, Wind, Bio and Geothermal as soon as you can. It will increase the chance of becoming viable sources when the others start to run out. Solar Space and Fusion may be the only things around in 50 years so don't be left out of the market – invest now and get them going! A small investment in a non-producer is better than none and the Government may help.

Don't be afraid to sell if over-production happens with declining energy prices. Watch the running costs! Get together with others and make a long range plan. But don't take my word for it. Go for a whole new range of options and discover what may happen. Experiment is the name of the game.

If after playing a few times you feel that you could improve on the game, by all means do so and write to let us know. I would particularly suggest that you look at the Operational Costs and the rate at which they increase. The values I have chosen are fairly realistic – but very hard on the players.

"A leading computer company proves that if you've got something worth showing, it's good business sense to make an exhibition of yourself."



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COMPUTER

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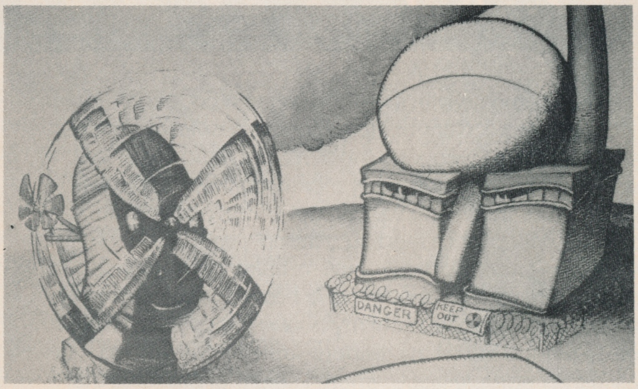
```
10 REM ENERGIESIC C.C. WALWYN
20 DIM R1(11),R2(11),C1(11),C2(11),P(11,20)
30 DIM S(11),X(11),O(11),V(11,20),N$(11),I(11,20)
40 DIM D(20),E(20),EV(20)
100 FOR J=0TO11
110 READ N$(J),R1(J),R2(J),C1(J),C2(J),P(J,0)
120 READ S(J),X(J),O(J),V(J,0)
130 NEXT J
140 DATA COAL,60000,6000,500,250,129
145 DATA 0,50,29,400
150 DATA OIL,4500,1400,200,150,124
155 DATA 0,100,29,400
160 DATA GAS,5000,2600,180,130,75
165 DATA 0,90,29,250
170 DATA FISSION,5000,2000,300,100,13
175 DATA 0,40,26,175
180 DATA FUSION,50000,10000,350,150,0
185 DATA 32000,35,25,100
190 DATA HYDRO,1000000,1000000,20,10,2
195 DATA 0,50,24,40
200 DATA WIND,1000000,1000000,100,50,0
205 DATA 3200,50,22,30
210 DATA TIDAL,1000000,1000000,100,50,0
215 DATA 2700,50,22,35
220 DATA S/EARTH,1000000,1000000,60,30,0
225 DATA 2200,60,20,25
230 DATA S/SPACE,1000000,1000000,1000,200,0
235 DATA 33000,100,10,80
240 DATA G/THERMAL,50000,5000,40,20,0
245 DATA 800,70,21,25
250 DATA BIOFUEL,1000000,1000000,200,100,0
255 DATA 3500,50,25,35
300 FOR J=0TO20:D(J)=1980+J*5:NEXT J
310 NN=1:E(0)=355:EV(K)=31
500 GOSUB2000
510 GOSUB2500
520 GOSUB3000
530 GOSUB4000
535 PRINT"□ALL GOVERNMENT SHARES ARE NOW SOLD BACK
537 PRINT"TO OPEN UP OPTIONS FOR PRIVATE INVESTORS"
538 GOSUB10000
540 K=K+1:IFK=20THENGOSUB15038:IFZ9THEN2000
545 E(K)=E(K-1)+INT((RND(1)*8-RND(1)*3)*2)
560 GOTO500
999 END
2000 REM INVESTMENT DISPLAY
2002 PRINT"□▚CURRENT ▀            VALUES PER 10% SHARE
2003 PRINT"▚CAPACITY▀──────────────────────────────────"
2005 D=K-2:IF D<0THEN D=0
2006 PRINT"▚IN MTCE.▀";
2007 N=0:FOR L=DTOK:PRINTTAB(19+N*6)"▚"D(L);:N=N+1:NEXTL:PRINT"⌂▓▓▓"
2008 FOR J=0TO11:A$="      "+STR$(P(J,K))
2010 PRINT "▚"RIGHT$(A$,5);"▀";TAB(9)N$(J);
2015 N=0:FOR L=DTOK:B$="▐▐▐▐▐"+STR$(V(J,L)):B$=RIGHT$(B$,5)
2017 PRINTTAB(19+N*6)B$;:N=N+1:NEXTL:PRINT
2020 NEXT J
2022 PRINT"▓▚"E(K)"MTCE▀ ARE REQUIRED IN"D(K)"
2024 PRINT"▓ENERGY IS WORTH"EV(K)"(M) PER MTCE.
2025 IF EV(K)<30THEN PRINT"WHICH IS LOW."
2027 IF EV(K)>35THEN PRINT"WHICH IS HIGH."
2028 GOSUB10000
2029 IF Z9THEN END
2030 RETURN
2500 REM INPUT INVESTMENT DATA
2505 PRINT"□":FORJ=0TO11
2510 PRINT"▓% OF INVESTMENT FOR "N$(J)"
2515 IF V(J,K)=0THEN PRINT"▚DOES NOT APPLY. IT IS SHUT DOWN.":GOSUB10000:GOTO25
60
2520 INPUT"(0-100)▐▐▐▐▐▚ ▀▌▌▌";A$
2525 IF VAL(A$)=0THENPRINTTAB(12)"□0":PRINT
2530 A=VAL(A$):IFA<0ORA>100THENPRINT"▚INVALID ENTRY":GOTO2520
2540 IFA/10<>INT(A/10)THEN PRINT"▚A MULTIPLE OF TEN PLEASE...▀":GOTO2520
2550 I(J,K)=A:GOSUB10100
2560 NEXT J
2570 PRINT"▓▓▚OK. IF EVERYONE HAS PAID THEIR MONEY,
2580 GOSUB10000:RETURN
3000 REM INITIAL ENERGY CALCULATION
3002 FOR J=1TO5:NEXT J
3005 J=0:D=1:C=0:X=1:PRINT"□OK...
3010 PRINT"▓I'M NOW CALCULATING HOW MUCH ENERGY
3020 PRINT"THE UK WILL BE GENERATING IN"D(K)
3025 PRINT"AND EXAMINING IF THE GOVERNMENT WISHES
3027 PRINT"TO DO SOME INVESTING OF ITS OWN...
3100 EP=0:FOR J=0TO11
3110 O=INT(P(J,K)*I(J,K)/100)
3130 EP=EP+O:NEXT J:GOSUB10100
3135 PRINT"▓CURRENT ENERGY NEEDS:"E(K)"MTCE"
3137 PRINT"▓WE WILL BE PRODUCING:"EP"MTCE"
3138 GOSUB10000
3140 IF EP=>E(K)THEN3300
3150 REM ENERGY DEFICIT
3160 X=X+.04:IF E(K)>EP*XTHEN 3170
3161 IF X>1.4 THEN GOSUB15000:IFZ9THEN2000
3162 REM ACCEPTABLE DEFICIT
3164 PRINT"▓THERE IS AN ENERGY DEFICIT SO THE GOV.
3165 PRINT"ANNOUNCES ENERGY CONSERVATION PLANS."
3166 PRINT"ENERGY PRICES RISE FROM"EV(K)"TO
3168 EV(K+1)=INT(EV(K)*E(K)/EP):IFEV(K)=EV(K+1)THENEV(K+1)=EV(K+1)+1
3169 GOTO3500
3170 PRINT"▓TO PREVENT A DEFICIT, THE GOVERNMENT
3175 PRINT"MIGHT MAKE SOME INVESTMENTS...
3180 C=INT(RND(1)*D*3)
3190 IF I(C,K)<100ANDP(C,K)>0THEN3230
3195 IF P(C,K)=0THEN3210
3210 C=C+1:IF C>11THEN C=0:D=0:GOTO3250
3220 GOTO3190
3230 IF R2(C)/P(C,K)<1THEN3250
3232 PRINT"▓▚THE GOVERNMENT TAKES UP ALL REMAINING
3234 PRINT"▚SHARES IN "N$(C)"."
3235 I(C,K)=100
3245 D=D+1:IFD>4THEND=1
3250 GOTO3100
3300 IF EP>E(K)*1.05 THEN 3400
3310 REM MILD SURPLUS
3320 PRINT"▓THE VALUE OF ENERGY REMAINS UNCHANGED AT";
3325 EV(K+1)=EV(K)
3330 GOTO3500
3400 PRINT"▓THERE IS AN ENERGY SURPLUS WHICH WILL
3410 PRINT"REDUCE THE ENERGY PRICES FROM"EV(K)"TO"
3420 EV(K+1)=INT(EV(K)*E(K)/EP)
3425 IF EV(K)=EV(K+1)THEN EV(K+1)=EV(K+1)-1
3500 PRINTEV(K+1)"MILLION POUNDS PER MTCE
```

Key to Symbols

□ Clear Screen
▚ Reverse field On
▀ Reverse field Off
▓ Cursor down
▐ Cursor right
▌ Cursor left



```
3510 GOSUB10000
3520 RETURN
4000 REM ENERGY CALCULATION SOURCE BY SOURCE
4005 GOSUB10300
4010 FORJ=0TO11:EX=0:D=0:L=0:E=0:C=0:P=0
4015 IF V(J,K)=0THEN PRINT"□▚"N$(J) "IS NO LONGER IN PRODUCTION":GOTO4600
4016 GOSUB6000
4020 REM L:TOTAL MONEY INVESTED
4030 L=I(J,K)*V(J,K)/10
4040 REM C:TOTAL RUNNING COSTS
4050 C=O(J)*P(J,K)
4052 IF P(J,K)=0THEN4500
4055 EX=L-C
4060 IF C<=L THEN 4100
4065 REM NOT ENOUGH TO MAINTAIN RUNNING COSTS FOR ONE YEAR!
4070 PRINT"OWING TO LACK OF MONEY ,"D(K)"OUTPUT OF
4074 Z=INT(L/O(J))
4075 IFZ=0THENPRINTN$(J)" ENDS. ▚FINANCIAL DISASTER !":P(J,K)=Z:GOTO4160
4076 PRINTN$(J)" HAS FALLEN FROM"P(J,K)"MTCE
4078 PRINT"TO"Z"MTCE.";
4079 IF Z*2<P(J,K)THEN PRINT"▚...VERY BAD NEWS!":GOSUB10200:GOTO4090
4080 IF Z*1.2<P(J,K)THEN PRINT"▚...NOT GOOD!"
4090 PRINT:P(J,K)=Z:P(J,K+1)=INT(Z/1.5)
4100 PRINT"▓AFTER 5 YEARS..............
4102 PRINT"▓TOTAL MONEY INVESTED........(M)"L
4103 P=INT(EX/X(J)/2.5)
4105 E=INT(EV(K+1)*P(J,K)*5)
4106 IF EX<=9THEN4110
4107 PRINT"▓(OF WHICH,"EX"(M) WILL BE USED"
4108 PRINT"TO BOOST EFFICIENCY & CAPACITY.)
4110 PRINT"▓TOTAL SALES.................(M)"E
4115 C=C*5:D=E+L-C
4120 PRINT"▓TOTAL RUNNING COSTS.........(M)"C
4135 PRINT"▓THEREFORE GROSS PROFIT......(M)"D
4150 IF D=>0THEN4200
4160 IF P(J,K)=0THEN4186
4162 PRINT"▓▚THERE IS NO CONFIDENCE IN THE FUTURE
4165 PRINT"▚OF "N$(J)" AND SHARE PRICES FALL FROM
4170 V(J,K+1)=INT((V(J,K)*10+D/2)/10)
4175 IF V(J,K+1)<V(J,K)/2THEN V(J,K+1)=INT(V(J,K)/2)
4180 PRINT"▚"V(J,K)" TO "V(J,K+1)" MILLION POUNDS.
4185 IF P(J,K)>0THEN4190
4186 V(J,K+1)=INT(V(J,K)/2):PRINT"▓▚YOU MAY INVEST AGAIN LATER BUT
4187 PRINT"▚"N$(J)" HAS GONE INTO LIQUIDATION.
4188 PRINT"▓▚ALL CURRENT INVESTORS PLEASE REMOVE ALL
4189 PRINT"▚SHARES FROM THE BOARD. YOU HAVE LOST    ALL YOUR MONEY"
4190 GOTO4600
4200 GOSUB10000
4210 GOSUB10100:PRINTN$(J),D(K)" - "D(K+1)
4215 O=D-(I(J,K)*V(J,K)/10)
4220 PRINT"▓AFTER PAYING BACK ALL INVESTMENT WE
4225 PRINT"ARE LEFT WITH PROFIT OF.....(M)"O
4227 IF O<=0THEN 4240
4228 IF P(J,K)>C2(J)*.75THEN4230
4229 XX=0:PRINT"▓MOST OF WHICH GOES ON FURTHER CAPACITY.":XX=1:GOTO4240
4230 PRINT"▓HALF OF WHICH GOES TO SHAREHOLDERS AND
4235 PRINT"HALF TO FURTHER DEVELOPEMENT & CAPACITY"
4240 R=P(J,K)*5:R2(J)=R2(J)-R:R1(J)=R1(J)-R:IF R2(J)<R*2 THEN 4260
4250 IF R2(J)>100000 THEN PRINT"▓UNLIMITED RESERVES OF "N$(J):GOTO4300
4255 PRINT"▓ECONOMICAL RESERVES OF "N$(J)" WILL
4256 PRINT"LAST FOR ANOTHER"INT(R2(J)/P(J,K))"YEARS"
4257 PRINT"& KNOWN RESERVES FOR"INT(R1(J)/P(J,K))"YEARS"
4258 PRINT"AT CURRENT CONSUMPTION PER YEAR."
4259 GOTO4300
4260 PRINT"▓IT IS GETTING MORE AND MORE EXPENSIVE
4265 PRINT"TO OBTAIN "N$(J)"."
4270 PRINT"▓OPERATING COSTS ARE SPIRALING UPWARDS..."
4275 O(J)=INT(O(J)*(1+RND(1)/5))
4280 PRINT"IT NOW COSTS "O(J)"PER MTCE.
4281 IF P>0ANDRND(1)>.6THENPRINT"▓MONEY IS REQUIRED FOR NEW TECHNOLOGY.":P=0
4282 IFP=0THEN4300
4284 Z=INT(R1(J)*RND(1)):IF Z>2000 THEN Z=2000
4285 R2(J)=R2(J)+Z:IFR2(J)<RTHENPRINT"▓PRODUCTION CUT BACK TO PRESERVE STOCKS"
4286 IF R2(J)<RTHENP(J,K+1)=INT(P(J,K)/1.3):GOSUB10000:GOTO4310
4287 IF R1(J)<R*1.5 THEN10500
4288 IF R1(J)<R*3THENPRINT:PRINT"▓▚WARNING!▀ "N$(J) WILL RUN OUT SOON!"
4290 PRINT"▓BUT THERE HAVE BEEN NEW DISCOVERIES...":GOTO4255
4300 GOSUB10000
4305 P(J,K+1)=INT((XX*O/2+O)/2/X(J))+P(J,K)+P
4310 PRINT"□YEARLY CAPACITY IN MTCE FOR "N$(J)
4320 GOSUB10100
4330 D=K-1:IF D<0THEN D=0
4340 N=0:FOR L=DTOK+1:PRINTTAB(10+N*6)"▚"D(L);:N=N+1:NEXTL:PRINT"⌂▓▓▓"
4350 N=0:FOR L=DTOK+1
4360 PRINTTAB(10+N*6)P(J,L);:N=N+1:NEXTL:PRINT
4364 IF P(J,K+1)<C1(J)THEN4373
4365 PRINT"▓▚THE "N$(J)" INDUSTRY IS TOO LARGE AND  ":P(J,K+1)=INT(P(J,K+1)/2)
4366 PRINT"▚EXCEEDS THE MAXIMUM PRACTICAL CAPACITY."
4367 PRINT"▚HALF OF THE PLANTS HAVE HAD TO BE SHUT"
4368 PRINT"▚DOWN AND CAPACITY IS CUT RIGHT BACK.  "
4369 PRINT"▚SHARES HAVE BEEN UNREALISTICALLY HIGH "
4370 PRINT"▚FOR YEARS AND ARE THEREFORE CUT BACK.":V(J,K+1)=INT(V(J,K)*RND(1))
4371 IF V(J,K+1)<V(J,K)/2THEN V(J,K+1)=INT(V(J,K)/2)
4372 PRINT"▓▚NEW CAPACITY="P(J,K+1)"MTCE.":GOTO4410
4373 IF P(J,K+1)<C2(J)THEN 4400
4375 PRINT"▓▚YOU'RE OPERATING NEAR THE UPPER LIMITS
4380 PRINT"▚OF PRACTICAL CAPACITY FOR "N$(J)"!"
4382 GOSUB6400
4385 IF RND(1)>.3 THEN 4400
4387 PRINT"▚▓LACK OF SUITABLE DEVELOPMENT AREA AND
4390 PRINT"▚UNPOPULARITY HAVE INCREASED YOUR RUNNING";
4391 Z=INT(O(J)*(1+RND(1)/4))
4392 PRINT"▚COSTS FROM"O(J)"TO"Z
4394 O(J)=Z
4400 V(J,K+1)=V(J,K)+INT((O-XX*O/2)/20)
4410 PRINT"▓OLD INTEREST VALUE PER 10% SHARES="V(J,K)
4420 PRINT"▓▚NEW INTEREST VALUE PER 10% SHARES="V(J,K+1)
4460 GOTO4600
4500 PRINT"▓"N$(J)" IS NOT IN PRODUCTION YET.
4515 IF I(J,K)=0 THEN V(J,K+1)=V(J,K):GOTO4600
4520 PRINT"▓HOWEVER INVESTMENT IS BEING USED IN
4530 PRINT"NEW RESEARCH AND IT IS ESTIMATED THAT"
4540 EN=V(J,K)/2*I(J,K):S(J)=S(J)-EN
4545 V(J,K+1)=V(J,K)
4550 IFS(J)<=0THENP(J,K+1)=1:PRINT"ITS  VIABLE NOW!":ND=2:GOSUB10400:GOTO4600
4555 R=INT(S(J)/V(J,K)/5)+D(K)
4560 PRINT"USEFUL ENERGY WILL BE BEING PRODUCED
```

TOMMY'S TIPS

We start this month with me admitting to a couple of deliberate errors. Contrary to rumour, it is definite editorial policy to have a few boobs (no that's not quite the word I mean)... a few mistakes every month, so that people will write in to complain and we can get some feedback as to how many people are reading different parts of the magazine. If nobody mentions a mistake, perhaps nobody read that article. Of course, I have been absolutely buried with correspondence about my boobs (I must learn a new word!). In fact, BOTH my readers wrote in! My first mistake was in the February issue, where I said that pressing the STOP key causes location 155/$9B to change from 0 to 16. Of course, what in fact happens is that it changes from 255 to 239, that is pressing STOP (and various other keys) causes bits to be cleared, not set.

The second little inaccuracy was in the March issue, "Scrolling Down". If you change every occurrence of CHR$(148) to CHR$(19) and every occurrence of CHR$(19) to CHR$(148) you should end up with a working program. My apologies to Adam Gawne-Cain who sent in the program: his version was perfect. Again, my apologies to anyone who was puzzled by these little quirks.

And so without further ado:

.USR v. .SEQ

Dear Tommy,
What is the significance of the .USR filetype on DOS 1 disk drives? Is it by any chance a way of recording Random Access files on the Block Allocation Map so they are not released by a Validate?
P.J. Jones

I am afraid not. In fact, as far as I can tell, there is no difference between .USR and .SEQ! Of course, I would be delighted if anyone has any information to the contrary.

Stack 'n Store

Dear Tommy,
Can you explain what the stack does in BASIC, and can it be used directly for any useful purpose?
D. Foster

The stack is used in BASIC to store quite a few things. The main uses are to store information on FOR-loops and subroutines, but it is also used when BASIC is evaluating an expression. As parts of the expression are evaluated they are pushed onto the stack to be used later in the calculation. The BASIC interpreter like any assembler program, uses the stack for its own subroutines. Unfortunately, none of this information is accessible from a BASIC program. To get at it you need to know the current value of the processor stack pointer, which is difficult to do from BASIC.

Cassette con?

Dear Tommy,
Why can some home computers use a domestic cassette recorder while others need special units? Is this a con?
F. McMaster

The answer is yes and no. To be really useful for storing data files as well as just programs, a tape unit really needs to have some form of electronic control, so that the computer can turn the motors on and off as it wants. Most small domestic recorders do not have this facility. The other reason is that the manufacturer is then sure how the cassette recorder will behave.

Domestic recorders vary widely in performance, and if users hang any old recorder onto their machines and get poor results, this rubs off on the computer, even though it may not be its fault. In addition, domestic recorders have their own power supplies, possibly mains-driven, which can cause problems, possibly even damaging the computer.

Really high quality computer cassette decks have features normally only found on reel-to-reel tape decks, such as high speed searching, which allows random access, but these are not normally found on home computers. You may be able to get your own recorder to work with a machine which normally uses a 'special', but it is likely to be more bother than it is worth, unless you are an expert and doing it for fun. Better in my opinion stick with the recommended system which is guaranteed to work reliably.

Get the point

Dear Tommy,
I am told that my Apple calculates using 'floating point' arithmetic, but I am very hazy about how it actually works. Can you explain it to me? What is the difference between floating point and fixed point?
W. Bruce

This is a matter which always causes confusion to people learning about computer arithmetic. It is one of those things that you can bend your brain over for days without understanding it, then suddenly it will click and you will be saying, "Of course, it's obvious!"

'Floating point' to a computer in fact has a FIXED binary point (unlike fixed point arithmetic!!). The paradox arises because the name refers to the number as the human sees it, not the computer. Most people are familiar with scientific notation, where 3500 becomes 3.5×10^3.... A floating point number looks very much the same in fact. It has a fractional part (sometimes incorrectly called a mantissa by confusion with logarithms) and an exponent (also sometimes called the characteristic). On the Apple (and Commodore machines), the fractional part has 4 bytes, with one for the exponent; and the binary point lies just to the left of the most significant byte of the fractional part. Thinking in decimal, the number 100 is stored at 0.1 (fractional part) and 3 (exponent).

The exponent is the number of times we have to shift the fractional part to get the original number, so starting with 0.1 we get 1, 10 and finally 100. To make things a little harder to understand, the exponent is "excess 128"; which means that an exponent of 0 is represented by 128, 1 by 129, -1 by 127 and -2 by 126.

Another convention is used to represent the sign of the number. The most significant bit of the fraction part is really always a 1, so in practice, this bit is used to give the sign of the number: 0 being positive, 1 negative.

Here are some floating point numbers. The numbers in the floating point column are in hexadecimal to make it easier to visualise the bit patterns, and we have separated the characteristic to make it easier to see.

DECIMAL NO.	FLOATING POINT NO.				
-3	82	C0	00	00	00
-2	82	80	00	00	00
-1	81	80	00	00	00
0	00	00	00	00	00
1	81	00	00	00	00
2	82	00	00	00	00
3	82	40	00	00	00

Note that zero is a special case, represented by 5 zeros. Let us analyse the number 1 to see how the floating point number is formed. First we look at the characteristic, 81. Remember that we are using excess-128 (that is 80 in hex), so 81 refers to 2 to the power one. The most significant bit is always a one (even though it is replaced with a zero for positive numbers – I warned you it was mind bending!).

We are now going to shift the fractional part left one place; left because the number is positive, one place because the characteristic is one over the 80. What 'falls off' the left will be our number. Just looking at the top byte, because all the others are zero we get:

```
BEFORE SHIFT              AFTER SHIFT
  10000000           1        00000000
```

Hey presto! We have a 1. Let us try it with 3. This time we have to shift left twice, because the characteristic is 82. The top byte of the fractional part is 40, which is really C0 because the top bit is always set:

```
BEFORE SHIFT              AFTER SHIFT
  11000000          11        00000000
```

Praise be, it works! Try it with the other numbers until you get the hang of it. Incidentally, whole books have been written about the pitfalls of writing floating point routines – there are many pitfalls for the unwary. Fortunately, most of us are able to keep clear of them.

Oops, I almost forgot, you asked about fixed point as well. Fixed point is where you convert all inputs to integers for calculation, then convert back to output the results. For example, if a program accepts a money value such as £100.00, the program multiplies by 100 to get 10000 (pence), which is used to calculate, say the VAT: 1500, which is divided by 100 to get the output value 15.00. Many high level languages such as FORTRAN and COBOL handle this 'scaling' of input and output automatically, and integer arithmetic routines are much simpler than floating point!

P.S. This must be the longest 'tip' I have ever produced! I'm glad I get paid by the word!.

New printer words

Dear Tommy,
I have been looking around for a new printer, and found that printer manufacturers are using lots of new words unknown when I bought my reconditioned golfball. Most of these are fairly obvious but can you explain 'logic seeking' and 'proportional spacing'?
B. R. Brace

I must say I sometimes get a little taken aback myself at some of the features you can get in remarkably cheap printers these days. I can remember several years back you could pay well into four figures for a printer which could only print upper case, had none of these fancy features and staggered along at just over 100 cps, but enough of my meanderings!

Logic seeking applies to bidirectional printers, that is, those which print both while the head is going left to right and when it is on its way back. On a non-logic seeking printer, the head always traverses the full width of the paper, regardless of how much or how little is to be printed on the next line. If a printer has logic seeking, when the printer has finished one line, the head will stop until the next line comes in from the computer, then it will decide whether it has to move left or right, and by how much, to get to the start of the next line. In this way a lot of unnecessary head travel is got rid of.

Proportional spacing makes the printer output look less like a typewriter and more like printed text, such as *MicroComputer Printout*. Another name for it is 'even white space' printing, which makes it a bit clearer. What it means is that if you print two narrow letters such as "i" together, the printer will squash them together to close up the gap, and if you print two wide characters such as "M", the printer will space them apart so they do not run into each other. The idea is to keep the amount of white space in between the characters more even. This does mean that you cannot tell how long a line is going to be, because every character is not now 0.1 inch from its neighbour. Most dedicated word processors can cope with this, (though few micro packages can) but the only other real use is for 'fixed format' printing, say of a standard letter, where you can experiment with your text to find out how many words fit onto each line.

Sinclair round up

Dear Tommy,
I have a Sinclair ZX81, and I have a programming problem I would like you to solve. How can I round a number to 2 decimal places, as in pounds and pence? Is it possible to have a general rounding routine to round to any number of decimal places?
M. Peters

This is a very common requirement, so this routine should be of interest to many of our readers:

```
1000 LET Z = Z * 100
1010 LET Z = Z + 0.5
1020 LET Z = INT (Z/100)
1030 RETURN
```

This rounds to 2 decimal places. Three can be achieved by changing the factor 100 to 1000 etc.

6502 Instructions

Dear Tommy,
Could I please have a complete list of the 6502 instruction set with both the Assembly language mnemonics and the equivalent Hex codes. Could I also have a simple description of what each instruction does. Oh!! I almost forgot, would you happen to know where user memory begins and ends on the unexpanded VIC-20 and where the routine for the PRINT statement is located.
K. Wells

Apart from his two queries Mr Wells eulogised at great length about the magazine in general and this column in particular. Take note: how to get your letters printed in this column! I can resist everything except flattery *(and beer and beer and more beer – Ed)*. If you are interested in learning 6502 assembler, can I recommend the book by Lance Levanthal? A complete list of 6502 instructions is really beyond the scope of this column, and anyway, we ran an article on assembler quite recently (July – Dec 1981).

User RAM on the basic VIC runs from 4096 (hex 1000) to 7680 (hex 1E00). The PRINT statement actually starts at $CA9A, but the two most useful entry points are $CB1E and $CB25. $CB1E prints a string addressed by the AC (LSB) and YR (MSB) which ends in a byte containing zero. $CB25 prints a string pointed to by locations $22 and $23 whose length is given by the value in the XR. In both cases the string should be less than 256 characters long.

WHICH BUSINESS SYSTEM?

Last issue we commenced our series of record-cards giving the low-down on several popular computer models. We continue this month with a look at five more typical installations.

We stress, as before, that if you are considering purchasing your first microcomputer system, it is very important to study the software first. Make sure that there is a package available that will provide the functions you require, and is operated in a fashion you can understand. Secondly, you should check up on your supplier – can he provide satisfactory after-sales support both in the form of hardware servicing, and software advice over the telephone.

Nevertheless, we feel that it is very useful to have a good idea of the pros, cons and background to most of the popular hardware on the market. Not only in case you still end up with a choice of machines, but also to help you decide on which vendors to try out first.

These handy system record cards are designed to help you check out what the hardware salesman tell you – and make your system choice from an informed position.

Listed on each card you will see some brief specifications and an approximate retail price. This includes keyboard, screen, disks and any requisite interfaces – but not a printer. Though several of the suppliers recommended the manufacturer's unit to go with a system, we found that each could operate a wide range of branded printers, though sometimes an additional interface costing £100 or so was needed.

The price also included operating system software, and in some cases, more than one programming language. You should allow extra for applications packages, however.

You will also find sections for Advantages, Disadvantages and our Comments – perhaps the most useful data of all. In a couple of sentences we have tried to sum up what we know of each machine, based on inside industry knowledge, reader's letters and our own technical evaluations.

Finally, there is a typical user. This should not be taken as the only type of user, but rather as an example application which makes best use of the machine's features.

NEC PC-8000

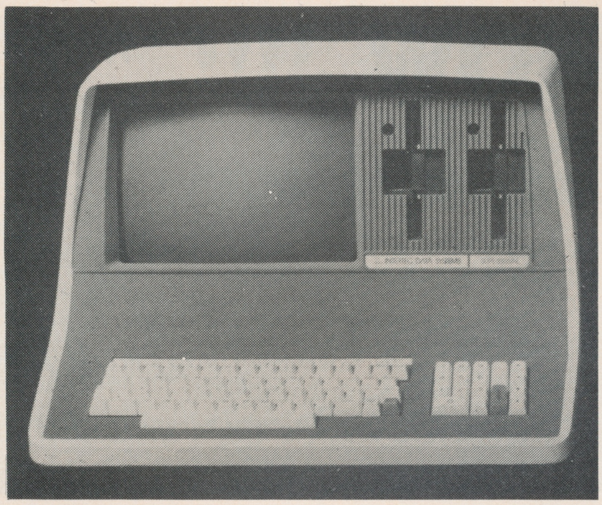
PROCESSOR:	μPD780C-1 (Z80 compatible)
RAM:	32K
SCREEN:	8 colour, high resolution, up to 80 characters wide.
KEYBOARD:	Numeric Keypad, Programmable Function keys
LANGUAGE/O.S.:	N-BASIC in ROM, CP/M
DISK CAPACITY:	280K
PRICE:	£1900

ADVANTAGES: Complete system from screen to printer, with various expansion facilities can be purchased from one supplier. Neat design. Keyboard console has BASIC in ROM and colour facilities without recourse to plug-in enhancements. This is in keeping with Japanese reputation for reliability.

DISADVANTAGES: Though the UK distributors (IBR) are actively developing and buying software, relatively few of the CP/M packages make good use of high resolution colour and programmable function keys.

COMMENTS: The NEC is perhaps the only Japanese colour micro which is being actively marketed and supported with software in this country. Costs can be saved by buying a monochrome or low-res colour monitor and upgrading it later.

TYPICAL USER: Business where computed results are to be presented to clients – or in a design office where colour is mandatory.



SUPERBRAIN

PROCESSOR:	Z-80
RAM:	64K
SCREEN:	80 x 25
KEYBOARD:	Numeric keypad. Programmable function keys
LANGUAGE/O.S.:	CP/M
DISK CAPACITY:	320K
PRICE:	£2000

ADVANTAGES: All-in-one integrated design. Good keyboard. Good value for money. Most types of application package available.

DISADVANTAGES: Not much software written specifically for this machine. Physical construction could be better designed.

COMMENTS: A very popular machine for running CP/M packages without expensive hardware. Consequently it is widely sold for running Wordstar, along with a suitable daisywheel printer.

TYPICAL USER: Small business wanting good word processing on a budget.

ACT SIRIUS I

PROCESSOR:	Intel 8088, 16 bit
RAM:	128K
SCREEN:	Variety of configurations up to 132 characters wide.
KEYBOARD:	Numeric keypad. Programmable keys. Keys for volume and screen brightness.
LANGUAGE/O.S.:	CP/M and MSDOS (used on IBM Personal Computer).
DISK CAPACITY:	1.2MBytes
PRICE:	£2400

ADVANTAGES: Superb ergonomic design with detachable low-profile keyboard and adjustable non-glare screen. Compatibility with IBM hardware good for future software. 16-bits means high speed. High-speed communications ports will ultimately permit networking.

DISADVANTAGES: New machine and processor means a current lack of software written specifically to take advantage of this machine's special features.

COMMENTS: Very definitely a major step forward in microcomputer hardware – designed by Chuck Peddle (father of the 6502 and Commodore PET). The whole machine is 'soft' in design so that character fonts, display size, operating system and programming language can be altered and stored on disk.

TYPICAL USER: Modern office requiring up-to-date design and versatile display for management accounts, etc.

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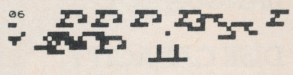
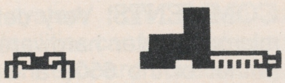


BUG SPLAT



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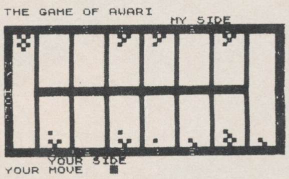
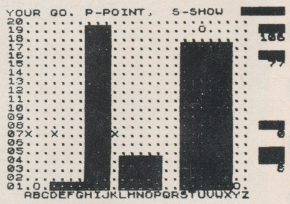
CASSETTE TWO
Ten games in Basic for 16K ZX81

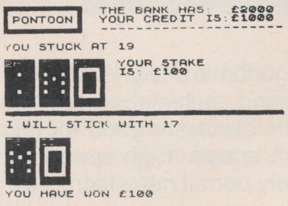
AWARI


THE GAME OF AWARI
MY SIDE
YOUR SIDE
YOUR MOVE

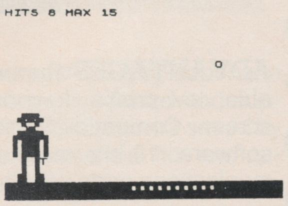
RECTANGLES


YOUR GO. P-POINT, S-SHOW
186
ABCDEFGHIJKLMNOPQRSTUVWXYZ

PONTOON


PONTOON
THE BANK HAS: £2000
YOUR CREDIT IS: £1000
YOU STUCK AT 19
YOUR STAKE IS: £100
I WILL STICK WITH 17
YOU HAVE WON £100

PENNY SHOOT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COMMODORE 8000

PROCESSOR:	6502
RAM:	32K
SCREEN:	80 x 25
KEYBOARD:	Separate numeric keypad
LANGUAGE/O.S.:	BASIC in ROM
DISK CAPACITY:	1.0 MBytes
PRICE:	£1800

ADVANTAGES: Good disk capacity. Clear screen. Lots of well tried software from Commodore Approved dealers. Large installed user base.

DISADVANTAGES: Physical design rather outdated and clumsy. Won't run CP/M programs except with £500 peripheral. ROM-based programming language inflexible.

COMMENTS: The 8000 series is the business version of in the PET range, and though it will soon be getting a bit long in the tooth, it still represents excellent value-for-money.

TYPICAL USER: Company with large database of records, or requiring specialist packages, e.g. Estate Agents, Doctors, etc.

HEWLETT PACKARD HP125

PROCESSOR:	Z80
RAM:	64K
SCREEN:	80 columns – high definition characters
KEYBOARD:	Detachable. Numeric keypad, Function keys
LANGUAGE/O.S.:	CP/M
DISK CAPACITY:	512K
PRICE:	£3600

ADVANTAGES: Superb ergonomic design both with the high-definition screen and 'friendly' keyboard – the bottom line of the screen indicates what the function keys are for.

DISADVANTAGES: High price (HP sales policy does not permit discounting). Relatively limited number of dealers means that software packages developed are likely to be only of a specialist nature.

COMMENTS: Really a Rolls Royce machine – the HP125 marks Hewlett Packard's entry into the small business market. It is supported by a limited range of very high quality software – including VisiCalc 125, Word 125, BASIC 125, Graphics 125 and Link 125 (for communications).

TYPICAL USER: Company requiring best in reliability and user friendliness, good communications facilities, or ability to drive printers, plotters and laboratory equipment.

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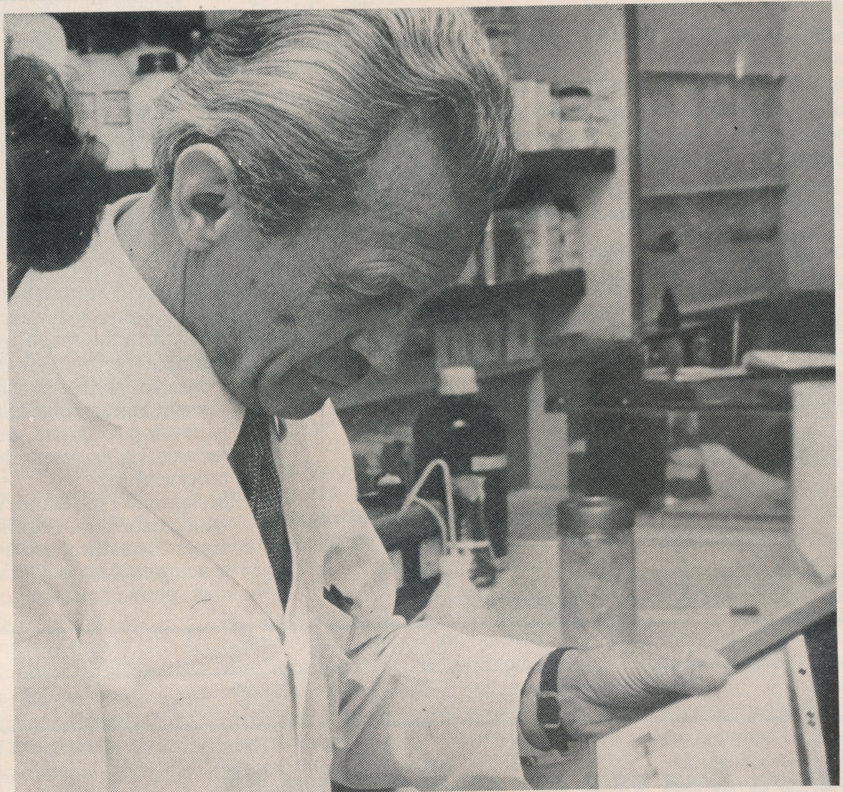

Can Computers ease the Strain?

Are microcomputers being actively used to assist the doctor in making diagnoses, or can they really only help in the administration side of his practice? **Martin Hayman** took a trip to the surgery....

Medicine was one of the first professions to be touched with enthusiasm for computing. In the early 1960s, when the future potential of artificial intelligence systems started to be bruited abroad, it was predicted that doctors would become obsolete, to be replaced by super-clever, rule-based diagnostic computer systems. Such systems would "learn" from experience and synthesise the expertise of many doctors to yield diagnoses which, based as they would be on a much larger corpus of information than any one human being can access in short-term memory, would be more accurate and reliable than a human's. The diagnostic, or intellectual as opposed to manipulative (surgery, physiotherapy) side of medicine would become a highly automated procedure.

Wild predictions

These wild predictions are not only in practice way wide of the mark; they have actually set back the cause of the computer in medicine, alienating doctors and patients on the one hand, and raising hopes unrealistically high on the other. At least, so says Dr Tim de Dombal, a surgeon at St. James Hospital, Leeds, who has researched computer aids for medical diagnosis since 1969 and has one of the few proven systems currently in use. Says de Dombal: "The computer was set on in the early 1960s to replace doctors, and in my view enormous harm was done to the field of computers in diagnosis."

Now there is a far greater awareness on the part of the public about what computers can and cannot do. This is largely courtesy of the micro, which has given many more people access to the machine and hence some understanding of its operation. Their expectations of computing have been scaled down and there is less paranoia

▶

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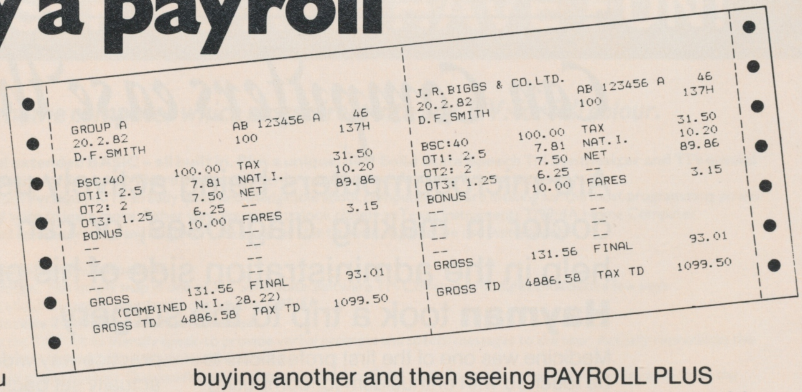

```
GROUP A                  AB 123456 A      46
20.2.82                  100             137H
D.F.SMITH
                                        31.50
BSC:40          100.00   TAX            10.20
OT1: 2.5          7.81   NAT.I.         89.86
OT2: 2            7.50   NET
OT3: 1.25         6.25   --              3.15
BONUS            10.00   FARES
--                       --
--                       --
--                       --             93.01
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GROSS           131.56   FINAL
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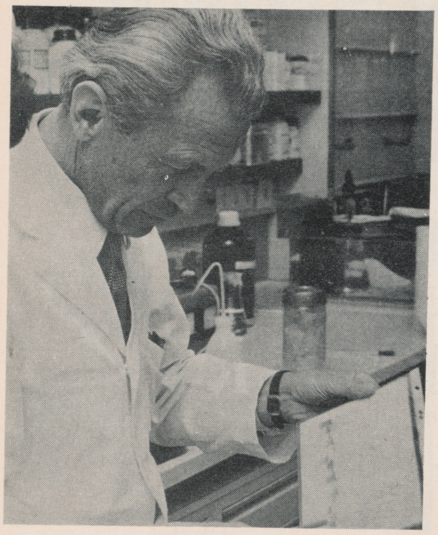

about computers "taking over". Many will have experienced computers in a small business environment, and this is the area where the majority of "medical" systems running on micros are to be found. After all, a general practice is not so different from any other kind of small business which offers a service – in terms of software writing. The principal difference which we shall come to later, lies in the general practitioner's desire to make full notes, in a fashion which is difficult to reduce or "tokenise", thus requiring copious storage. This leads to the argument that very little medical computing can be done on a micro, because it is neither reliable nor fast enough.

Diagnostic machine

The more interesting application of computing in medicine, and that which characterises computing for doctors rather than any other profession, is nevertheless in the diagnostic field. De Dombal has probably the most effective computerised aid for diagnostic decision-making available today and has demonstrated that a surprising amount can be achieved with relatively little outlay. Note that it is not a diagnostic machine, but an aid. De Dombal is very strict on this point: "None of us here in Leeds thinks that the day has come when the computer can make diagnoses," he warns. "I don't see it happening in my working lifetime (20 years) and I hope it won't." A computer, as all the elementary text books on computing emphasise, can only go to work on strictly defined quantities. There are many ways in which a doctor can establish that a patient's health is not all it should be, many of them unquantifiable. "The only things you can feed into a computer are symptoms or signs," he says. "But if you see a child and say to yourself, 'My goodness, he doesn't look well today', there's no way you can feed that into a computer."

De Dombal prefers to see his system as an aid in the same way as an X-ray machine, an electrocardiograph or as a Coulter counter for analysis of blood samples. Each or any of these mechanical aids may be used in arriving at a diagnosis, though none of them actually signals a course of action. "A doctor can look at any X-ray and say, 'I don't believe it'. Without interpretation it can be quite wrong." How often was his diagnosis aid "quite wrong", I asked. He told me that the diagnostic accuracy of his system was 70-90% compared with the usual SHO diagnosis rate of 50-60% in this particular field (abdominal pain). These figures are impressively backed up by over 20,000 case studies from Leeds, Bangour in West Lothian and places as far afield as Mexico and Australia. All report on average a 20% improvement in initial diagnosis of abdominal pain.

Aide-memoire

How is it done? The answer lies in careful evaluation of the task in hand – again standard text-book stuff. In this case, de Dombal started his work more than ten years ago after a full three years spent evaluating the decision-making process in diagnosis. It starts by making prior assumptions on the likelihood of certain symptons leading to certain diagnoses. Severe lower abdominal pain, for example, may well be porphyria, as suffered by George IV; on the other hand it is far likelier to be appendicitis. The first move, then, is to assign a probability to the possible diagnoses of particular symptoms. As examination proceeds, the possibilities are modified to take account of observed symptoms, ending up with the posterior probabilities. As the computer is programmed, it will effectively give a check-list of symptoms to check for – functioning also as an on-line "aide-memoire". For this reason it is also a very useful learning tool for students: if they overlook to explore a certain possibility, either through forgetfulness or lack of experience, it will prompt them to go back and check for that symptom.

It all sounds blissfully simple; intriguingly, its principles are based on Bayes' theorem. Bayes was an eighteenth century English clergyman who used this mathematical model to prove the existence of God through observation of external phenomena; his theorem was found on his desk after his death and published in 1753. "It's a shame it'a not based on more up-to-date mathematics, but as it happens Bayes' theorem proves rather a good model for medical diagnosis." Reduced to medical terms, a great deal of data on the occurrence of abdominal pain (derived from the World Organisation of Gastroenterology's Research Committee) is used to weight the probabilities in the program's model; if you have severe lower abdominal pain, there is a 24% chance that you do have appendicitis.

The computer holds a large matrix of existing cases which are not, however, stored in an attributable form, thereby overcoming one of the principal objections to computers in medicine, that it is easy to correlate medical data with certain other kinds of computerised records – to the disadvantage of the subject. "If you, as a miscreant, try to come along and see if someone who is known to you is suffering from some unmentionable disease, you won't be able to." Though de Dombal has concentrated on abdominal pain, other hospitals have extended his work into the areas of jaundice and coma: conditions which some patients might prefer a prospective employer, say, not to know about.

De Dombal uses a PET, although the system is adapted to run on an Apple or a Wang 2200. When he first started computerising, he had the use of 1K on a Wang 770c. Consequently, his system is extremely economical: the Basic program, yielding a bar-chart read-out of diagnostic probabilities, plus the data module being worked on, is contained in a print-out as short (or as long, if you prefer) as your arm. This seems to be the case whether the program prompts are in English or any other of the languages in which the Leeds system is available: French, Flemish, Dutch, Danish, Spanish, Norwegian, or Thai. The system has 32K, with a further 154K overlaid in the form of data disks. Its compactness and simplicity prompted the British Medical Association's micro mastermind, Dr. John Dawson, to describe it as "one of the most elegant uses of the micro I have ever seen." What was the secret of its elegance? "It's elegant because it's simple; and if you know a lot of medicine, you'll know a student's priorities – the way his mind works when making a diagnosis."

Disaster area

By contrast, Dr. Mike Sheldon, who researches into expert systems for general practice at Nottingham University, would advise the GP to steer clear of micro-based systems. "I can take you to 12 practices which have bought small computers and they're all cursing the day that they ever heard of them. It's a disaster area." The needs of the GP, says Dr. Sheldon, are very similar to those of a small business. He needs to keep an age/sex register of his patients, with recall dates; he needs to be able to print out prescriptions and to handle his own accounts; and he needs to keep full clinical records of each patient. This last requirement is particularly consumptive of memory; Sheldon's prescription is a fixed Winchester at the least, preferably with another, removable disk. This is partly because of his views on the structure of medicine in the UK. He believes that the GP's surgery is the place where the majority of illnesses should be treated. GPs, he says, are an under-used resource; and that far too many patients are referred to consultants, with their long waiting lists. His aim is to provide the necessary tools in the GP's surgery to allow the vast majority of treatment to be done on the spot. Surely, I asked him, the GP generally sees people with minor complaints and hence is unlikely to need access to large-scale clinical databases through his own communications link?

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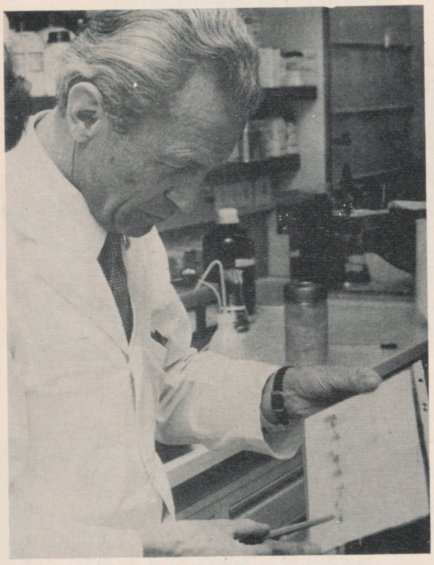

by then you may be dead. The vast majority of illness takes place in the community. It's a common misconception that health care takes place in hospitals. It doesn't. This is what makes the major difference." Dr. Sheldon's campaign to shift the burden of primary care back to the GP's surgery is perhaps a separate issue, but it does bear on his insistence that if computers are to be used in medicine, they must be thoroughly reliable and provide a wide range of facilities. At the same time, he argues that value-for-money is an essential criterion. A computer system should cost the GP no more than 50p per patient per annum to run; but the final results, he argues, if GP's were to be properly equipped with powerful computing systems, would be a tenfold improvement in the cost-effectiveness of the NHS. Dr. Sheldon speaks with some authority from his radical position. Over the past decade he has himself been a GP, a systems designer and now a researcher and lecturer. His own system, of which he sold on his own admission only one, comprised an Equinox Z-80 based machine with fixed and exchangeable disks, housekeeping and data back-up software, a high-grade printer and two VDUs.

Commercial sector

Is there a happy medium? Indeed, where to start? Doctors who feel that they should get into gear for the new age can do worse than get themselves down to the National Computing Centre, where several different systems for doctors are on display and can be demonstrated on request. In the commercially available sector, most packages major on age/ sex registers, repeat prescriptions and comment files, cross-referred by some means. Additionally, some offer means of searching data files according to certain criteria – say, in order to screen all patients over the age of 65, who have a history of bronchitis, or who smoke, in order to innoculate them against a current strain of influenza.

One of the senior demonstrators at NCC in New Fetter Lane, London is Eric Bagshaw. He told me that the doctors who enquired about computing generally fall into two categories: the older doctors who have read about computing and want to know what it can do for them, and the younger ones, possibly with some programming experience, who have already some firm idea of what they want a system for, and may even have a budget in mind. Mr Bagshaw makes the point that most GPs want to have lots of data on-line all the time the system is in use and broadly recommends that, in order to get full use of a system, the GP will need two terminals, one in his consulting room and one in his receptionist's area. Realistically, he reckons, the budget has to bust £3,000 for an entry-level system.

One of the most popular features he is asked about is full-text word processing. Many doctors develop certain idiosyncracies in writing up their clinical notes and do not see why the adoption of the computer should change their working habits. This is of course inordinately costly of memory and demands high-grade word-processing. At the same time, it represents a big investment in man-hours. A four-doctor practice might well have a panel of 10,000 patients; to enter full notes retrospectively would take a full-time typist some six months. The system would cost in excess of £10,000. Some of the packages we looked at had the disadvantage that records could only be accessed by patient codes: this is obviously fine for security purposes, though it means having a "crib-card" to hand. Admittedly this will usually be on the patient's card notes, which are unlikely to be replaced altogether by the computer. One suggestion is that the computer would print out a brief summary of notes, with the old manual card file kept for notes written out in full, correspondence with hospitals and other documents such as hospital reports and X-rays which are difficult, or expensive, to reproduce and/or store in a computer.

Simple systems

It is not difficult to work out how fast note-taking uses up memory: if you reckon that even an average set of notes would require 1,000 characters, and if there are 2,000 patients, you're into 2MB of data, strongly arguing the case for a machine which will support fixed and removable disks – the Comart Communicator, or the Rair Black Box (MP/M) for example. Even so, a software package written for the Communicator by Xitan Systems of Southampton (who are associated with Comart) and described as Medidata, requires that patient notes be "tokenised". This in turn compels the doctor to be rigorous. This takes us back to the starting point: you can only exploit a computer to the full if your inputs are unambiguous. In software writing terms it may be a good wheeze to assign meanings to certain keys in order to perform patient management searches (Xitan describe them as "switches") but a GP has an urgent need to get on with the job and has little time, unless he be an enthusiast, for user-savage programs. As Tim de Dombal puts it: "Simple systems are less of a threat. You must carry the doctor with you."

"Computing in General Practice"

Anyone contemplating writing a medical software package of any kind would be well advised to consult the British Medical Association, who in 1980 commissioned a study by Scicon Consultancy International on "Computing in General Practice". The study homes in directly on microcomputers, rejecting mainframes and bureau services as "inappropriate", but warns that quick action must be taken to avoid a proliferation of incompatible systems. It reviews systems currently in use, including conclusions drawn from in-depth interviews with users, detailed design considerations of hardware, software and communications, and goes on to recommend a jointly-funded pilot scheme to place 100 micros in general practices.

From the doctor's point of view, it gives a list of considerations for purchase, including a specimen maintenance agreement with the supplier. From the systems designer's point of view, it draws up a very detailed modular approach to analysing and implementing a full GP system, including a table to calculate memory size required by any particular size of practice, along with future possibilities which should be borne in mind when specifying hardware.

The research is thorough, based as it is on existing practice needs and doctors' expressed requirements, and the grasp of the subject is firm from both the computing and the applications side. It is also lucidly written. It costs £10 from the BMA, Tavistock Square, London WC2, which is peanuts for what is effectively a functional blueprint.

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```
  10 REM *NORMAL DISTRIBUTIO*
  20 INPUT X
  30 LET T=1/(1+0.231642*X)
  40 LET Q=1/SQR (2*PI)*EXP (-X*
*2/2)
  50 LET A=0.319382
  60 LET B=-0.356564
  70 LET C=1.781480
  80 LET D=-1.821256
  90 LET E=1.330274
 100 PRINT "PX=";1-Q*(A*T+B*T**2
+C*T**3+D*T**4+E*T**5)
```

Program 3

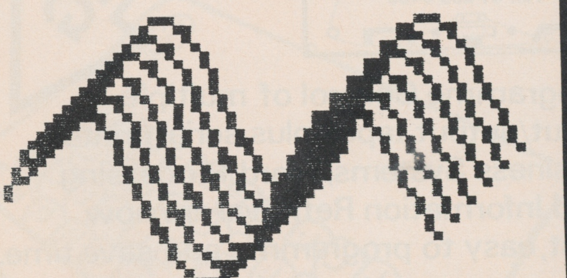
```
  30 LET T$=" ZERO  ONE   TWO
THREE FOUR  FIVE  SIX   SEVEN EI
GHT NINE "
  40 FOR Z=0 TO 9
  50 FOR X=0 TO 9
  60 LET K=1+6*Z
  70 IF Z=0 THEN LET Q$=""
  75 IF Z<>0 THEN LET Q$=T$(K TO
 K+5)
  80 LET K=1+6*X
  90 LET Q$=Q$+T$(K TO K+5)
  95 SCROLL
 100 PRINT Q$
 110 NEXT X
 120 NEXT Z

 ZERO
 ONE
 TWO
 THREE
 FOUR
 FIVE
 SIX
 SEVEN
 EIGHT
 NINE
 ONE   ZERO
 ONE   ONE
 ONE   TWO
 ONE   THREE
 ONE   FOUR
 ONE   FIVE
 ONE   SIX
 ONE   SEVEN
 ONE   EIGHT
 ONE   NINE
 TWO   ZERO
 TWO   ONE
```

Program 4

```
  10 REM *CELSIUS TO FAHRENHEIT*
  20 PRINT "CELSIUS TEMPERATURE?
"
  30 INPUT CEL
  40 LET FAH=1.8*CEL+32
  50 PRINT CEL;" DEGREES CELSIUS
 EQUALS"
  60 PRINT FAH;" DEGREES FAHRENH
EIT"
```

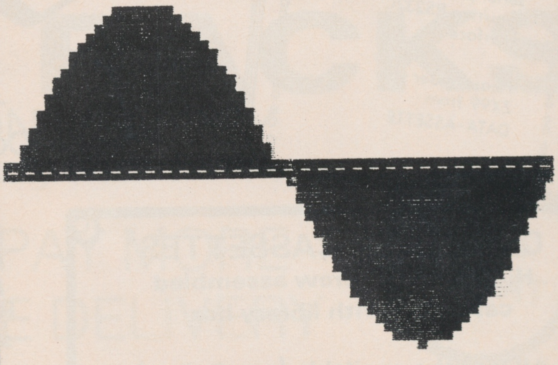
Program 5



```
   5 FOR D=1 TO 2
  10 FOR A=0 TO 10 STEP 2
  20 FOR X=0 TO 10 STEP .1
  30 IF D=1 THEN PLOT 5*X+A.10*S
IN (X)+10+A
  35 IF D=2 THEN UNPLOT 5*X+A,10
*SIN (X)+10+A
  40 NEXT X
  50 NEXT A
  60 NEXT D
```

Program 6

```
  10 FOR X=0 TO 63
  20 LET Y=20*SIN (X/32*PI)
  30 IF Y=0 THEN GOTO 70
  40 FOR N=0 TO Y STEP SGN Y
  50 PRINT X,N+22
  60 NEXT N
  70 NEXT X
  80 PRINT AT 10,0;"----------------
--------------------"
```



Program 7

```
PRICE PER DOZEN (IN £)?
AT £77 PER DOZEN
THE PRICE EACH IS £6.42
6.4166667


  10 REM *MONEY MANIPULATION*
  15 PRINT "PRICE PER DOZEN (IN
£)?"
  20 INPUT A
  30 PRINT "AT £";A;" PER DOZEN"
  40 PRINT "THE PRICE EACH IS £"
;INT ((A/12)*100+.5)/100
  50 PRINT A/12
```

Program 8

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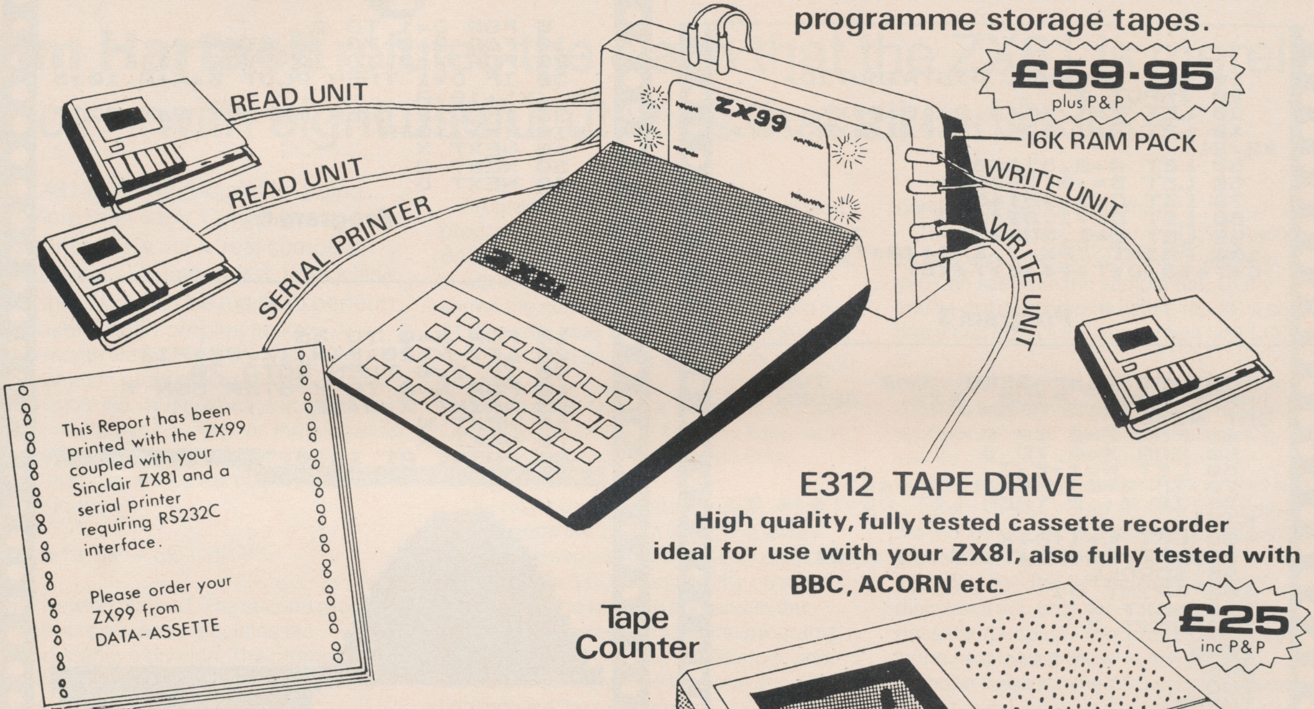
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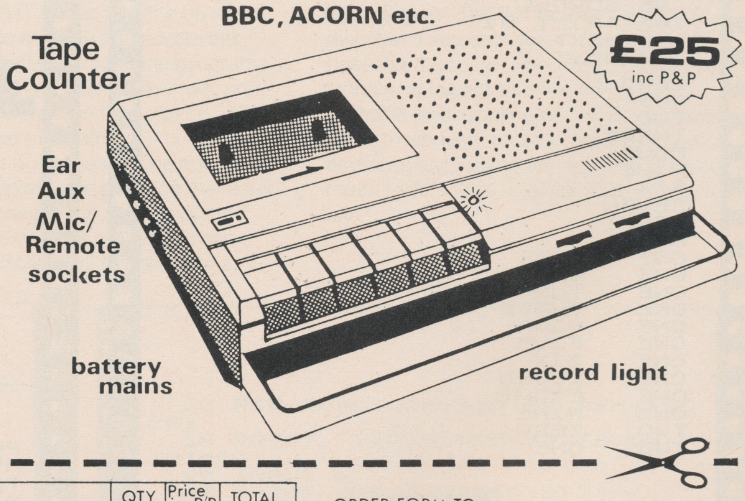
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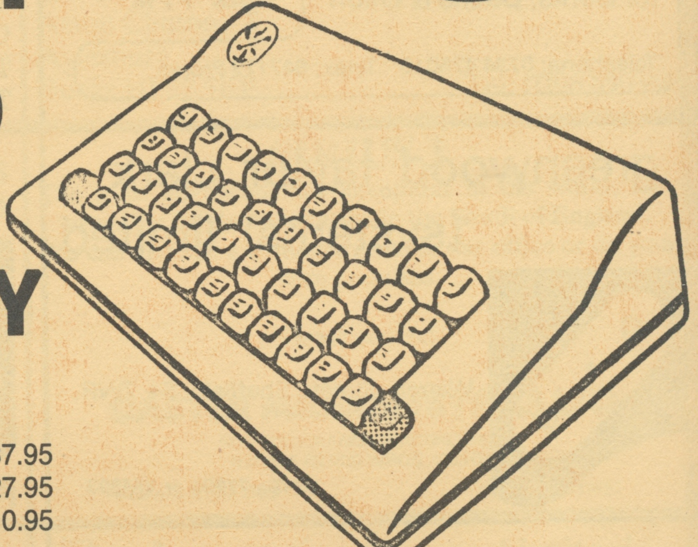

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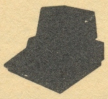

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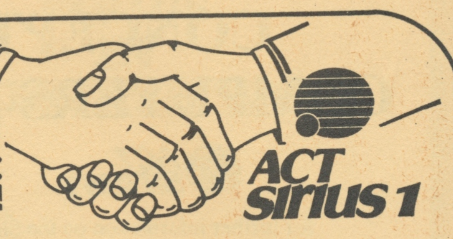

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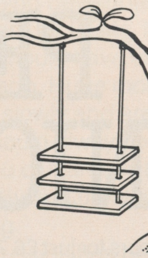
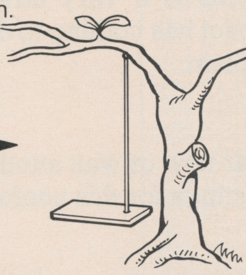
The seventies of course were the time which saw the rise of consultancies, in which others besides computer manufacturers became involved in systems specification and design.

You know what a consultant is, don't you? Herbet V. Krochnow defined a consultant as *"A man who knows less about your business than you do and gets more for telling you how to run it than you could possibly make out of it even if you ran it right instead of the way he told you."*

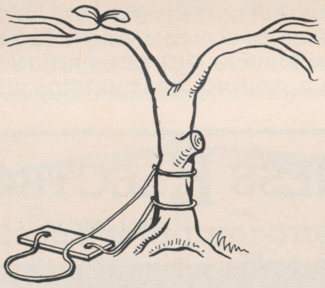
It was best put in the graphic form below by someone who had actually tried to implement a consultant's specification.



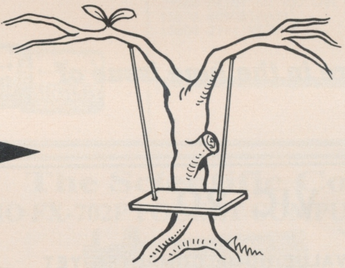
1. Consultant's original design



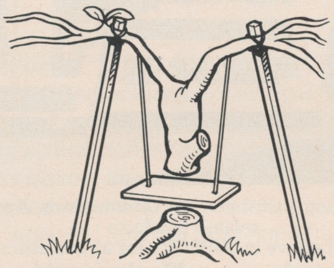
2. Revised design after costing.



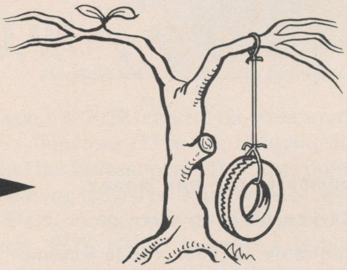
3. What the spec. said.



4. Team's implementation of the spec.



5. Hand-over version.



6. What the client needed.

The idea of the computer is itself a very powerful one. It was to be expected therefore that in searching for analogies, people should go to those also powerful sources, the Bible and The Book of Common Prayer.

And what could be more powerful than those opening words of Genesis. "In the Beginning...." So Iann Barron of INMOS once began a speech by updating the first half a dozen verses. "In the beginning was IBM..."

In the 70's, a UK systems house became involved in systems software for a famous manufacturer. And one of the things they produced was the following.

In the Beginning was the idea, and then the specification.

And the idea was without form, and the specification, it was void.

And darkness was upon the faces of the Programmers.

And they spake unto their Leading Programmer, saying: 'It is a load of crap, and smelleth as of a sewer.'

And the Leading Programmer took pity upon his vassals and spake to the Senior Programmer:

'It is a cartful of turds, and none may abide the odour thereof.'

▶ 91

NEXT ISSUE....

Electronic Mail
Just a vision of the future, or can you already send letters over the telephone? State-of-the-Art report.

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Everyone agrees the BBC is a very advanced machine. But its real impact has nothing to do with its specification. We explain.

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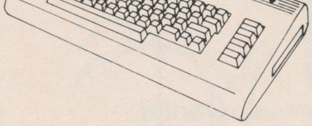

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◁ 57

Documentation

error – then you will get some really weird results!

One more table – a list of subroutines. This should include *all* subroutines in the program, saying what they do, which variables they expect as their inputs and what outputs they produce. One of the commonest errors involving subroutines is sending the required information – but in the wrong variable, especially easy if arrays are involved.

The final form of documentation I am going to mention is the REM statement. The poor old REM gets my vote for the most abused statement in BASIC. With the exception of maybe 8K PETs, 3.5K VICs and 1K ZX81s, *every* program has room for some REM statements, especially when the program is being developed. If a program is so big that there is no room for REMs, then you are a bad programmer: the program should have been split up into manageable chunks long ago. Huge monolithic programs are pigs to test, run very slowly and are awful to debug if they break down. You should always put REMs in when you start a program – you can always take them out later, but when a program is new and unreliable they can save an awful lot of pencil sucking.

This discussion has been mainly aimed at BASIC programmers, but it is all applicable to those who use assembly language, with the additional note that as comment in an assembler program is free, there is no excuse for not using as many as possible. As assembly language is lower level than BASIC, intricate routines can be even more puzzling when you come back to them, so adequate documentation is absolutely essential.

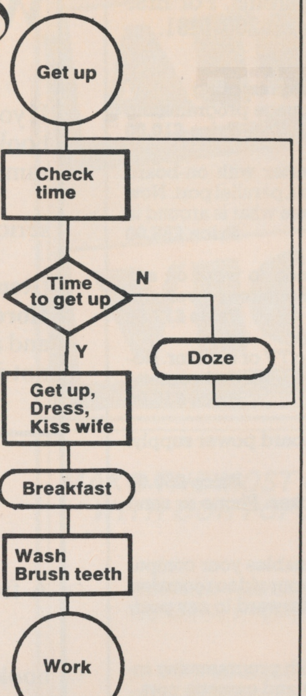
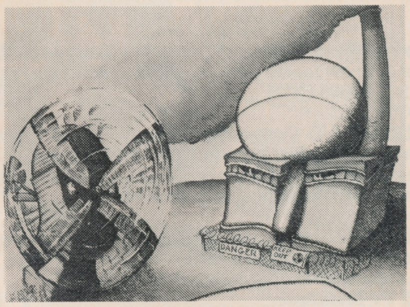


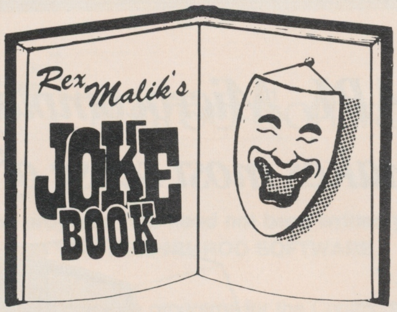
Diagram 1

◁69 ENERGY CRISIS



```
10200 REM ENORMOUS FALL OFF
10220 PRINT"█REDUNDANCIES AFFECT YOUR RUNNING COSTS
10225 X=INT(O(J)*(1+RND(1)/3)):IFX=O(J)THEN X=X+2
10230 PRINT"FROM"O(J)"MILLION POUNDS TO"X
10235 O(J)=X:RETURN
10300 REM INFLATIONARY WAGE CLAIMS
10310 IF EV(K+1)<=EV(K)THEN RETURN
10320 PRINT"█OWING TO THE RISE IN ENERGY PRICES,
10330 PRINT"THERE ARE PRICE RISES IN MOST ENERGY
10340 PRINT"RUNNING COSTS....
10345 PRINTTAB(13)"██"D(K);TAB(18)D(K+1)
10350 FOR J=0TO11
10360 PRINTN$(J);
10370 PRINTTAB(15)O(J);
10380 O(J)=INT(O(J)*(1+RND(1)/10))
10385 PRINTTAB(20)O(J):NEXT J
10390 GOSUB10000:RETURN
10400 REM NEW DISCOVERY BOOSTS SHARES
10410 V(J,K+1)=INT(V(J,K)*(1+RND(1)/ND*3))+1
10420 PRINT"█THIS NEWS MAY PUSH UP SHARE PRICES !"
10430 RETURN
10500 REM SOURCE  RUNS OUT
10510 PRINT"██THERE ARE NO MORE SUPPLIES OF "N$(J)
10520 PRINT"█ACCORDINGLY THE INDUSTRY HAS SHUT DOWN.
10530 V(J,K+1)=0:P(J,K+1)=0:R1(J)=0:R2(J)=0
10540 GOTO4187
15000 PRINT"██♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦
15010 PRINT"█THE SHORTAGE OF ENERGY HAS CAUSED THE
15020 PRINT"FRAME WORK OF BRITISH SOCIETY TO BREAK
15030 PRINT"APART. DISASTER AND REVOLUTION !
15035 PRINT"█THERE IS NOTHING I CAN DO ABOUT IT !
15038 PRINT"█YOU KEPT THE UK GOING UNTIL"D(K)"."
15040 PRINT"███END OF GAME. THANKYOU FOR PLAYING."
15050 PRINT"█I SHALL DISPLAY THE FINAL SHARE VALUES
15060 PRINT"SO YOU CAN SEE WHO CAME OUT OF IT BEST."
15070 GOSUB10000
15080 Z9=1:RETURN
```

◁89



.And so the Senior Programmer spake unto the Consultant, saying: 'It is a container of excrement and it is very strong, so that none may abide before it.'

The Consultant then hurried unto the Senior Consultant, and addressed him thus:

'It is a vessel of fertiliser, and none may abide its strength.'

The Senior Consultant carried these words to his Supervising Consultant and spake to him, saying:

'It containeth that which aids the growth of plants, and it is very strong.'

And so it was the the Supervising Consultant rejoiced and delivered the good news unto his manager:

'It promoteth growth, and it is very powerful.'

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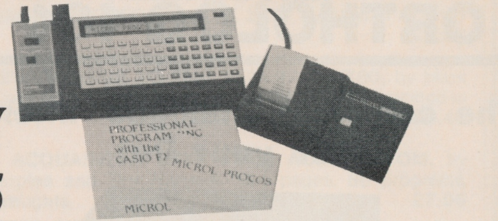
And the Managing Director looked up the new system, and said:

'It is a load of crap, and smelleth as of a sewer.'



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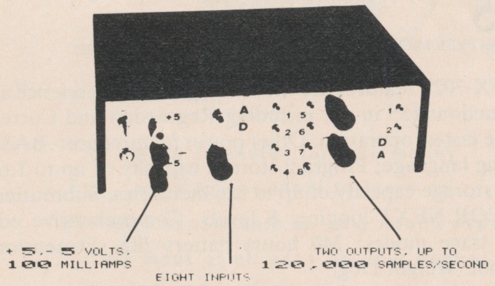

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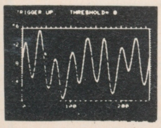

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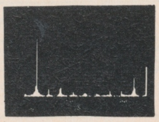

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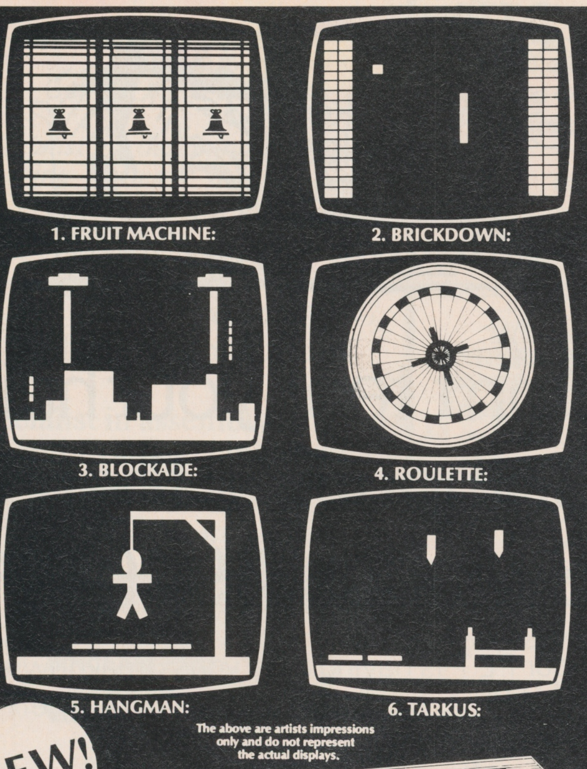
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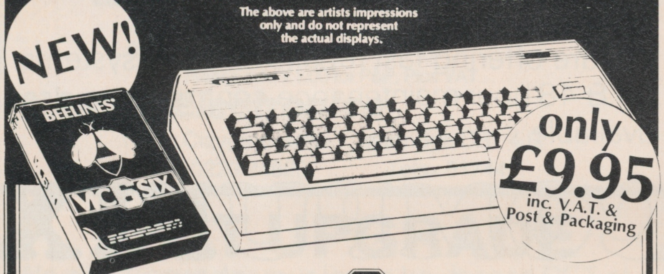
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INSIDE TRADER

I see that Commodore's UK Commandant, butch, Range-Rover driving Big Bob Gleadow, is making steady progress with his fiendish plan to gain control of the rest of the organisation. The company's international arm (C.E.L.) has just been removed, kicking and screaming from its luxurious Swiss headquarters to Leigh Road, Slough. Commodore UK recently vacated said offices on the grounds that they were unfit for human habitation.

Apple high command have emerged from their bunker after an extraordinary three day autopsy on the Apple III. The inquest verdict was 'premature introduction'. The new Apple IV, code-named LISA will therefore be introduced S-L-O-W-L-Y. This may be just as well as the Chief Engineer on the LISA project has defected to an outfit called Grid.

I predict an entertainingly acrimonious barney between Personal Software Inc., now pompously renamed VisiCorp, and their UK distributors, ACT Microsoft. Both companies are secretly plotting to get out of the contract; VisiCorp so it can take over the juicy European market itself; ACT to concentrate on more profitable IBM/Sirius and CP/M software. My friends in the legal profession are looking forward to some profitable litigation.

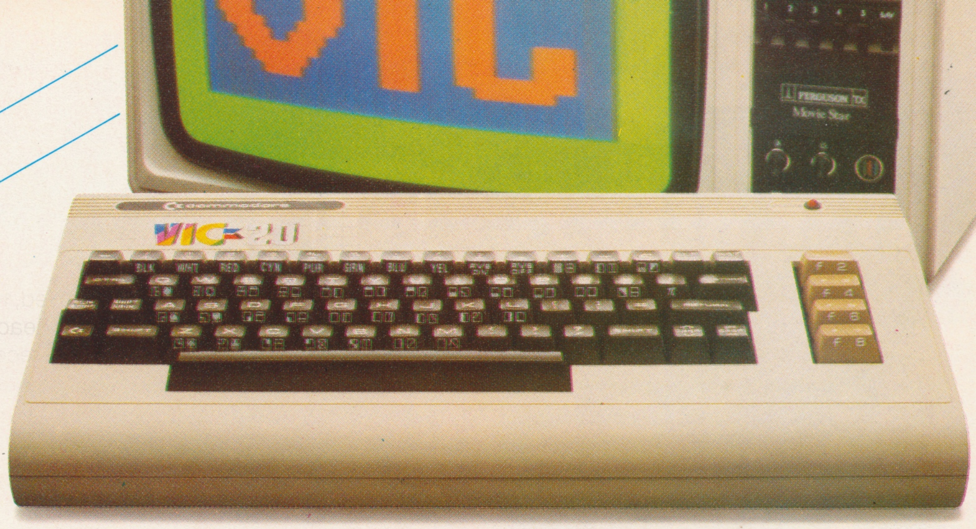
Floppy disk manufacturers should be quaking in their boots as word gets out of Bart Khan and his amazing cube. Mr Khan, who is chairman of a company called MicroXeno, says the six-inch cube will store at least 9.9 gigabytes (that's 9,900 million bytes) of data. For some reason no-one seems prepared to lend Mr Khan the money to manufacture the ineffable cube. MicroXeno recently advertised itself as "rapidly becoming the world's largest network of consultants...in computer technology." The company had five employees at the time.

Latest manufacturer to receive the sincerest form of flattery is Apple: some Taiwanese rotter is busy churning out counterfeit Apple IIs by the dozen. The only immediate way of telling the Chinese copy from the real McWozniak is to look for the 'Made in USA tag'. If it ain't there you've got yourself a Chang Kai Chek special.

'Colonel' Bruce Page's economic theories were a legend even at the New Statesman, *whence he recently departed the Editorship, not entirely of his own volition. Now the Colonel is tinkering with a computer model of the economy running on his £69 Sinclair ZX81. Seeing as how the Treasury's model of the economy keeps a multi-million pound Univac mainframe busy, I am not optimistic about the Colonel's chances.*

People Who Live in Glass Houses dept: My congratulations to Mr R. Sangster on his appointment as Tandy's Official Complainer-in-Chief and Literary Critic Extraordinaire. First to suffer Mr Sangster's wrath were ACT, who received a letter threatening dire retribution if a long list of complaints about the Sirius 1 brochure was not immediately rectified. The effect of this was somewhat dissipated by the non-enclosure of the list. I earnestly entreat those with a grudge against Tandy not to innundate Mr Sangster with erroneous excerpts from TRS-80 literature. His is address is Tandy Corporation, Tame Way Tower, Bridge Street, Walsall WS7 7LA.

Stop Press: Latest to receive one of Mr Sangster's mournful missives is none other than our Editor. I understand Mr Sangster is anxious to receive the sort of chain letters that bring all manner of disaster upon those unwise enough to break the chain.



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19. VIC 20 is truly expandable into a highly sophisticated computer system with a comprehensive list of accessories (see panel below).

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23. National dealer network providing full service and support to VIC owners.

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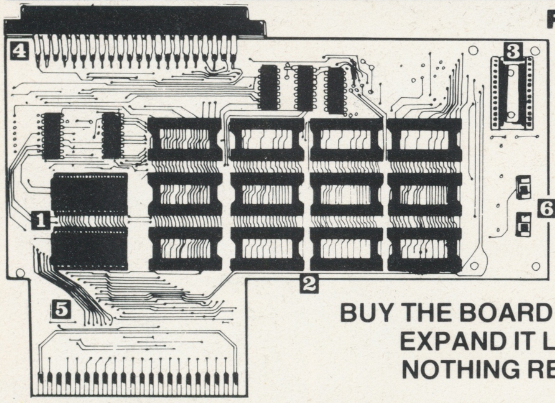

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```
RUN

?DIVISION BY ZERO ERROR IN 500
READY.
HELP
 500 J = SQR(A*B/C)

READY
```

HELP How many times have you wanted to scream "HELP!" when your VIC couldn't interpret your program and all it would say was **?SYNTAX ERROR**? Fret no longer: Now just type in **HELP** The line on which the error occurs will be shown and the erroneous portion of the line will be indicated in reverse video on the screen. Truly a great help in any learning or school situation.

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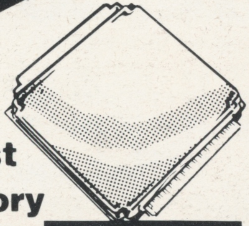

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Welcome to the world of personal computing. This booklet has been compiled to provide a thorough introduction for complete newcomers.

The information contained in these pages will tell you all you need to know before deciding whether computing is for you – and which is the right machine. All the articles have been selected from past issues of *MicroComputer Printout*, and are written in plain English. Any jargon words that you need to understand are fully explained.

MicroComputer Printout's aim is to provide practical and down-to-earth advice, for those who want to come to terms with the new technology – in business, school or home – but have no idea where to start. That is why we have chosen the blend of news, explanations and humour that you will find in each issue.

As well as increasing productivity and saving time and money, we believe computers can be great fun. We hope our magazine will persuade you, too.

Finally, we would like to express our thanks to Commodore for co-sponsoring the production costs of this booklet. The editorial content, however, is entirely our own.

Richard Pawson – *Editor*

Contents

The most asked Questions 3
Answers in plain English for absolute beginners

Compleat Computer Crib Sheet 4
What all those jargon 'buzzwords' mean

Anatomy of a Micro 8
How they work inside

The Software Buyer's Crib Sheet 10
How to spot a good package for business.

Which Home Computer 12
Consumer test on 8 popular machines

How to Choose 14
Getting the most for your money

MicroComputer Printout – a plain man's guide to personal computing – is published monthly and is available through all leading newsagents. One year's subscription costs £11.40 for twelve issues delivered to your door from: MicroComputer Printout, P.O. Box 2, Goring, Reading, England RG8 9LN. Telephone 0635-201131. Additional copies of this booklet – for use in education, training and business – can be purchased at £3.00 for ten copies including postage and packing.

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THE MOST ASKED QUESTIONS

1 Computers are getting cheaper all the time: shouldn't I wait?

Very much the same question used to be asked about pocket calculators. Some people struggled with tedious long division sums for years on the grounds that eventually they would get a calculator free in a Cornflakes packet!

It's all a question of cost savings really – the best reason for buying a micro in the first place is to save time and increase personal productivity. Besides which, the cost of a business system is *not* falling. What is happening is that the same money buys you more powerful hardware than before. But with software costs rapidly becoming the major component in the total system cost, it is unlikely you will save more than around £300 a year by deferring purchase. If your micro isn't saving you at least three times that figure each year, you aren't using it to full capacity. Alternatively, you have succeeded in computerising an application that didn't need it!

2 How much information can the computer store?

Information is actually *stored* in the floppy disk drive unit, the capacity of which is measured in KBytes (approximately 1000 bytes), or on larger systems MBytes (millions of bytes). Since each byte can hold one character of information, then a typical disk system with, say, 300KBytes could hold about 300,000 characters; that is equivalent to 200 A4 pages of solid typing. Although you can swop diskettes over to increase the storage, 300KBytes remains the maximum amount you can access at any one time.

Unless you are dealing solely with Word Processing, the figure of 200 pages is pretty meaningless. It is therefore important when buying a business system to find out its limitation *in terms of what you are processing.* In an Accounts Ledger, this could be the number of accounts or the number of ledger entries per month. In a Payroll, the key factor is the number of employees.

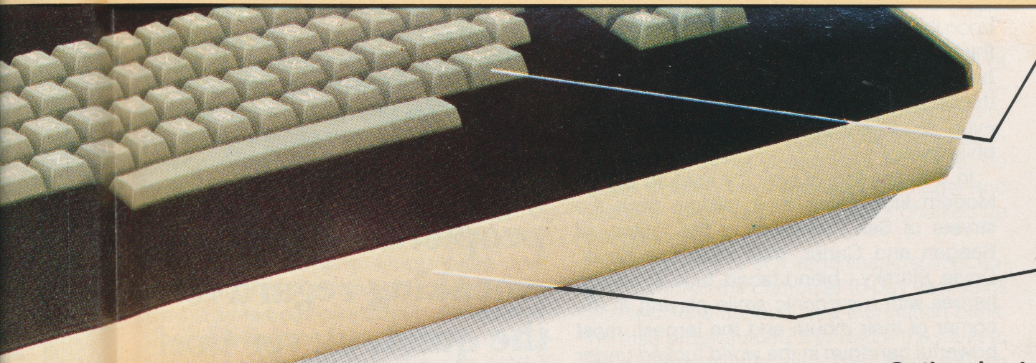
3 Why does software cost so much?

Perhaps one of the most surprising things to the newcomer in computing is that while hardware costs seem to be dropping fast, the price of off-the-shelf business software packages is rising. Indeed, on current projections, the software will comprise at least 80% of the cost of buying a business system in ten years time. But with an off-the-shelf package, surely all you should be paying for is the reproduction costs – say £10 for the diskettes and the same again for the instruction manual – with the rest being pure profit?

Alas, not! The real costs in software are in the development – and the reason these are rising is that business programs are becoming much more sophisticated. Whereas three years ago, you could get away with developing a couple of hundred lines of BASIC, a contemporary product may involve tens of thousands of lines of machine code – for which the development time may be measured in man-years rather than days. The good news is that a sophisticated business system will now perform more functions, more reliably, faster and with greater user-friendliness. The disadvantage is that the huge development costs have to be written-off over the expected number of sales. Many business packages, incidentally, sell no more than a hundred or so copies over their entire lifespan!

The important thing when buying software and trying to assess the value for money is to find out what level of support is included in the price. Many reputable suppliers will include a Software Maintenance Contract, which guarantees that any bugs will be corrected, and that you will automatically receive a free copy every time the program is revised or updated. Sometimes the price will include a fixed amount of staff training – and instant advice at the end of a telephone every time you run into a problem.

6



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THE COMPLEAT COMPUTER CRIB SHEET

There is a great definition of the difference between **Hardware** and **Software**: if you can kick it then it's Hardware! Hardware is the electronics and the casing in which they are mounted. Software is the **programs** you run on the computer. It's like a Hi-Fi system - the amplifier, record deck and speakers are all hardware, while the music you play on it is software.

The hardware of a microcomputer will consist of several parts including a **keyboard** for typing in instructions and a Visual Display Unit or **VDU** for displaying results. This could be your own T.V. set, or a specially modified screen built into the computer. On it you will be able to display **alphanumeric** characters (A-Z, 0-9 and punctuation) and special **graphics** characters for diagrams and drawings. These characters range from simple lines and squares, to intricate games symbols. The higher the **resolution** of your graphics, the finer the lines that can be drawn, and the smoother the curves appear.

Inside, the computer consists of **Integrated Circuits** (I.C.s) or 'chips' - small, solid-state electronic devices, encased in black plastic. The most important of these is the Central Processing Unit or **CPU**, which performs all the calculations and manages the whole system by shuffling information around its parts. The two most common 'models' of CPU are the MOS Technology **6502,** used in Commodore, Apple, Acorn and Atari microcomputers, and the Zilog **Z-80** used by Tandy and Sinclair amongst others. Two other popular CPUs are the Motorola **6800** and Intel **8080**.

The computer has two types of memory. Random Access Memory or **RAM** is temporary memory - anything stored in it is lost when you switch the computer off - the technical term is **volatile.** RAM is used to store all the **commands** (instructions to the computer) you type in, the program which it is currently running and all the **data** to which that program refers. This data consists of **variables;** a variable is just one item of information and has a name which identifies it e.g. PRICE and a value - 5, perhaps. **Integer** variables can only cope with whole numbers, **Floating Point** variables can cope with decimals as well. **String** variables are not numbers, but strings of characters (such as someone's name or address) which can be **sorted** into alphabetical order, or **searched** for references to a particular word or 'phrase'.

ROM (Read Only Memory) is permanent memory - you can't alter it, and switching off won't erase it. ROM is used to store the special programs that tell the microcomputer how to behave.

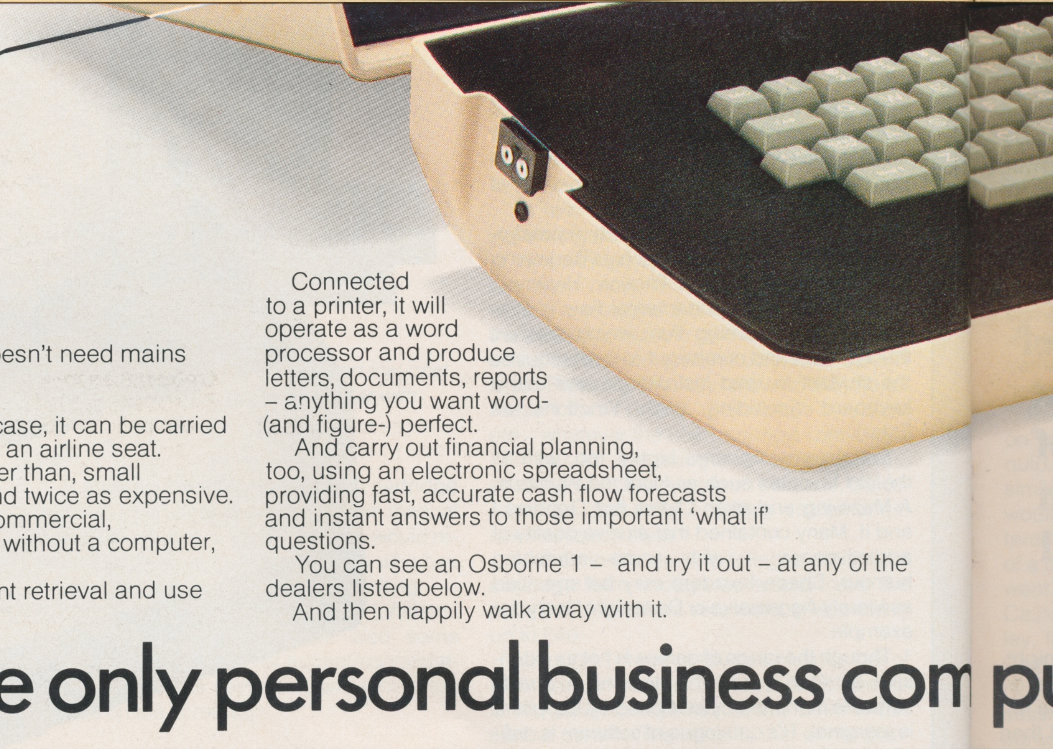
These include the **Operating System** which enables the CPU to manage the keyboard screen and memory all at once. Operating Systems vary greatly from machine to machine though there are a few standard ones including **CP/M** and **Unix.** The advantage is that applications programs written on one computer using one particular operating system should be compatible with any other running the same operating system, regardless of its individual design.

There are other types of memory, such as **PROM, EPROM, EEPROM** and even **EAROM,** each with their own redeeming features, but these are generally only used in specialist devices, or for development purposes prior to full-scale production.

All forms of memory are measured in the same units. A **Bit** - short for Binary Digit - is the basic unit of computer memory, and can only be used to store a '0' or '1' - equivalent to being switched off or on. These are compounded into larger units to store useful information. Eight Bits form a **Byte** and most CPU's process one byte at a time. A byte is usually the equivalent of a single digit or character, but can represent something more abstract.

Some of the newer and more advanced CPU's, like the 68000 and Z8000, process 16 Bits at a time, a considerable increase in speed. A typical process might be carried out in approximately a millionth of a second!

Exactly 1024 Bytes makes one kilobyte or **KByte** - so that a 32K



Interface.

IEEE 488 Interface. Connects the OSBORNE 1 to the standard instrumentation bus, for data communication with test instruments.

Osborne 1.
It doesn't need a room of its own.
Or even a desk of its own.
With its optional battery pack, in fact, it doesn't need mains electricity for up to two hours.
It's – as you can see – portable.
Weighing under 24lb in its weatherproof case, it can be carried in one hand. Or in your car. Or tucked under an airline seat.
But its performance is equal to, often better than, small business computers several times as big and twice as expensive.
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computer in fact has 32x1024 or 32768 bytes of memory. The reason for that strange number is that it can conveniently be expressed in **Binary,** which is the numbering system used by computers.

The CPU is only capable of very crude operations - such as adding two digits - but can execute them at very high speed. To make it perform any real function, the CPU needs to be given a long list of instructions - a program - written in a form it can **Machine Code.** Unfortunately it is almost incomprehensible to humans, consisting of rows of digits, the result being very slow programming and many errors!

Various **high-level languages** for computers have therefore been developed, which are rather closer to English, and hence easier to program in. **FORTRAN** is a language suited to Engineering calculations, whilst many business programs are written in **COBOL.** By far the most common language, and incidentally the easiest to learn, is **BASIC;** fortunately it is *fairly* compatible from machine to machine. The most standard is called **Microsoft** BASIC and is found on PET, Apple and many others. Of increasing popularity is **PASCAL,** which is harder to learn, but better for writing large programs, and inducing good 'program discipline' in new programmers.

Programs written in a high-level language have to be converted to Machine Code before they can be run by the CPU. There are two types of special program that carry out this translation. The first is the **Compiler** which translates your whole program into Machine Code before executing it. An **Interpreter** works through your program line by line, translating and executing as it goes. Typically an Interpreted program will run 10 times slower than a compiled one, but will use up less memory because only one version is stored. Interpreters are more useful if you are developing a program, since the discovery of an error - a **Bug** in computer jargon - does not necessitate recompiling the entire program. The precise difference between Interpreting and Compiling takes rather more explanation. Those interested should read our article "Compiling For Speed" in the July issue.

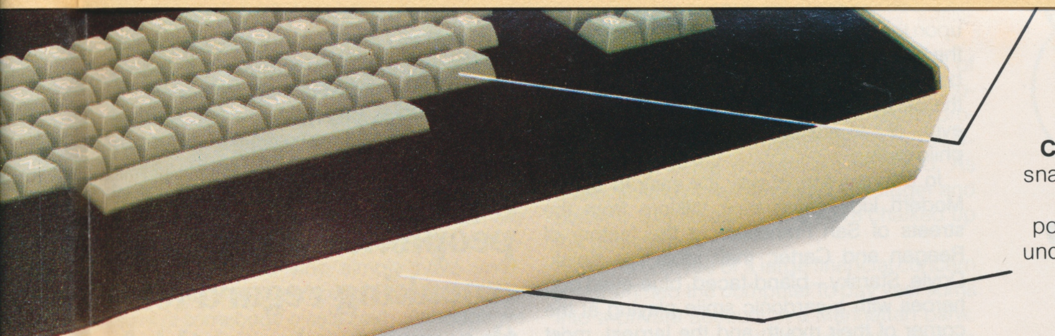
If a computer is designed to handle a number of different programming languages, the various Interpreters and Compilers will be stored in RAM. Machines which only run BASIC, however, generally have an interpreter in ROM. This kind of software, permanently embedded in Hardware, is sometimes called **Firmware!**

And so back to hardware. The I.C.s are held in place on a Printed Circuit Board, or **PCB,** which is a stiff card with many fine copper tracks that interconnect the components. Indeed some cheap computers, called **Single-Board** computers, *only* consist of a PCB. You need to be a dab hand at soldering to assemble the components into a working computer.

Protruding from the extremities of the PCB are the **Interfaces** which allow the computer to exchange information with other electronic devices. This exchange is known as **Input/Output** or I/O. An interface will consist of several lines or wires - called a **bus** - to handle the data and sundry control signals needed to synchronize the timing of the various operations. The sequence of events involved in exchanging a piece of data is called the **protocol** - a term doubtless derived from the ritual dance of diplomacy. This terminological jest is carried a stage further with one particular sequence of events in an interface being known as a **handshake;** this signifies that the transaction is complete!

There are several common interfaces as well as a number of obscure and non-standard ones. Unless you buy a special conversion box, you can only connect together devices having the same interface. **IEEE 488, RS232** and **S-100** are some of the most widely accepted standards. The first of these is a bus, meaning that 8-bits are transmitted simultaneously down 8 lines. The second is a **serial** interface, so called because the bits are transmitted one after the other down a single line; this is more economical for transmission over long distances. S-100 has one hundred lines but is only used for connecting together PCBs inside one box. The number of bits sent per second is called the **Baud Rate.**

These interfaces are most frequently used by a microcomputer for communicating with its **peripheral** devices. They are



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- Modem cable for use with acoustic couplers for telephone transmission of data
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THE MOST ASKED QUESTIONS

A good yardstick is to find out how widely a program has sold. If you know that a particular product has been on sale for several months and is widely advertised by a number of manufacturers or dealers, then it is reasonable to assume that the quality relates to the price.

The need for caution arises when buying specialist software – sometimes referred to as the Butcher, Baker and Candlestickmaker Accounting packages! You may find that the program was originally written as a consultancy job for a client, and that the dealer is trying to make a fast buck selling you a copy for £500. There is no guarantee that the program is bug free, the documentation was probably written by an engineer, and the programmer, who is the only person who can even read the source code, has long since retired to the Bahamas!

4 *Why do I need two Disk Drives?*

Although most microcomputers either have two floppy disk drives built in, or rely on a similar twin unit as an external peripheral, some manufacturers offer a single drive unit. So who is right?

The main advantage in having two drives is the ability to copy information from one diskette to another. It also enables you to keep different disks for different purposes. In some business systems, for example, the diskette containing the program is always located in the right hand drive, with its partner being reserved for the user's own data. This allows the program diskette to be Write Protected (see *Do You Need Disk?* September issue) to prevent the user from accidently erasing or overwriting the program itself.

The ability to copy from one diskette to another is most often used for making regular backup or security copies; this is necessary to guard against the possibility of a database becoming corrupted by hardware failure to operator incompetence. The theory is that even if you lose everything, it should only be necessary to backtrack to the time when the last copy was made – which should be daily or weekly, if you are a gambler.

Partial copying of information is used to prepare copies of, say, the week's results, to be fed directly into another microcomputer system somewhere else.

There are some applications which you can get away with using a single drive unit. These tend to be more concerned with computing power, than the storage of long-term and critical information. Two such examples are management calculations (such as *VisiCalc*) and simple Word Processing. Providing that you have been supplied with one back-up copy of the program – the loss of data on such a diskette would not usually cause a calamity.

One important point is that there is no advantage in having more than two drives. Though some systems demand three or four drives, this is solely because the storage capacity of two is insufficient. The result is not only clumsy to operate, but can be less reliable, and you should seriously consider going to an alternative supplier for higher capacity drives.

5 *Does the computer need a special kind of environment/power supply?*

The days when computers needed a special room of their own equipped with a massive air conditioning and power supply unit, are thankfully gone. Nor, incidentally, do you need a staff of men in white coats and horn rimmed spectacles to operate a microcomputer! Unless, of course, you are making a T.V. film!

All desktop computers run from an ordinary domestic mains socket, and actually consume much the same amount of electricity as a single light bulb. Unless you are working in an industrial environment, where there might be extremes of temperature or condensation, you shouldn't have too many problems with your micro.

Electronic equipment, however, is susceptible to electrical interference, either from heavy

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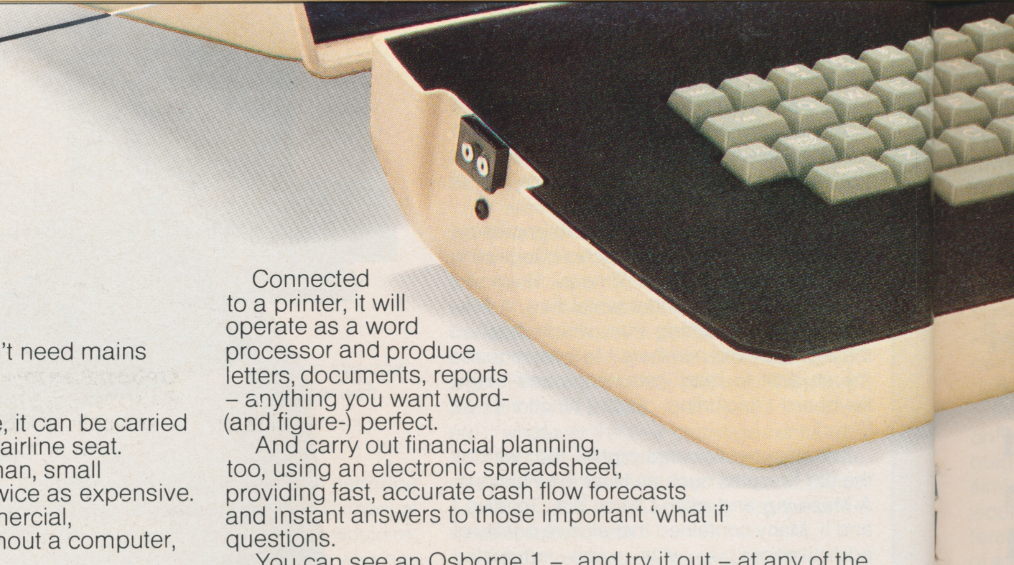
IEEE 488 Interface. Connects the OSBORNE 1 to the standard instrumentation bus, for data communication with test instruments.



Osborne 1.
It doesn't need a room of its own.
Or even a desk of its own.
With its optional battery pack, in fact, it doesn't need mains electricity for up to two hours.
It's – as you can see – portable.
Weighing under 24lb in its weatherproof case, it can be carried in one hand. Or in your car. Or tucked under an airline seat.
But its performance is equal to, often better than, small business computers several times as big and twice as expensive.
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duty industrial machinery, or from mains voltage fluctuations. The latter, which is what you are experiencing every time a light bulb flickers, can cause a microcomputer to 'crash'. Although this should not damage the hardware, it can mess up software on disk, and be generally inconvenient.

If your home or office is particularly prone to this affilication, you can buy (for around £100) a mains regulation unit which will smooth out any irregularities in the supply.

6 *Why are there so many keys?*

Full typewriter-like keyboard – say the advertisements, though none of them exactly resembles a typewriter. Historically, the computer keyboard evolved from the punched card tabulator and has brought with it a number of anachronisms. The '*' symbol is used in place of a multiplication sign, for example.

Some of the additional keys have standard meanings, others vary from machine to machine, so we will briefly review the various different types.

First the number or *numeric* keys 0-9. Rival suppliers seem unable to agree on whether these are best located above the QWERTYUIOP row as on a typewriter, or on a separate calculator-style numeric keypad, which is faster for entering large amounts of numeric data. Some machines overcome this design dilemma by featuring *both* sets of numbers, which can be a little confusing for the beginner. In this case, the result will be the same whether the 9 key is pressed on the top row of the keyboard or on the separate keypad.

The next group are the Screen Editing keys. These allow you to modify whatever is on the screen by inserting and deleting characters, whole lines of text, or diagrams. The most important are the Cursor keys which may be marked CRSR or with direction arrows. Their purpose is to move the small flashing square, or cursor, in the direction indicated by the arrows. Any action specified by pressing further keys, will take place from where the cursor is currently positioned.

There are usually also a number of Control keys which govern the running of a program. There may well be one marked RUN, which starts the program, and another marked BREAK or STOP, to halt temporarily the execution. Others such as CTRL and ESC, act like the Shift key in the sense that they only work in conjunction with another key (A-Z), to activate some special function.

Finally, some of the newest and most user-friendly systems have User Definable Keys, also known as Programmable Function keys. These are usually blank or labelled F1, F2 ... F10 etc. They may be assigned special functions by the user or by an applications program. This not only saves time by replacing oft-used sequences of keystrokes with a single button push, but can make the program much easier to operate by people unfamiliar with computer techniques. Some keyboards even have small labels above these function keys on which you can write your own legends.

7 *How fast can the computer retrieve information?*

Paradoxically, the answer is that it depends on how much you know about what you want to find out! Confused? We will start at the beginning.

If you ask for the Stock Record for product number 1463, the program will know exactly where on the disk it is stored and need only wait for the recording head to move to the right place. Result: you can see the Stock Record in about a second.

Now suppose that you know the product is called a *widget*, but can't remember the number. The program almost certainly maintains a cross-index of these two items, so it should only delay the process for another couple of seconds or so.

However, if you request something along the lines of "that product which is supplied by the ABC Company" – then the computer may have to inspect each record individually until it finds a match.

Don't be fooled by the salesman's impressive demonstrations – the chances are that his disk only contains ten example stocklines. So if your business demands a thousand or so, then the process could be slowed down by a factor of as much as one hundred.

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CRT – Cathode Ray Tube

Shown transparent here, this is identical to the tube found in a small domestic T.V. set. Essentially it is an evacuated glass tube with a phosphorescent coating inside. Electrons are 'fired' from a gun at the back, 'steered' by magnetic fields generated by coils of wire on either side, causing the coating to give out light where they strike. The *definition* of a built-in screen is better than on a separate T.V. screen, the background being black rather than grey. The *resolution* of the screen – which determines how smooth a curve you can draw – is generally a function of the driving electronics, and not of the tube itself. Most CRT's are green or white in colour, though there is now a trend towards yellow/brown which is said to be easier on the eyes.

PCB – Printed Circuit Board

The Printed Circuit Board is the most convenient way of both physically holding and interconnecting a large number of electronic components, and as such forms the main identifiable structure of a microcomputer.

A PCB is a piece of stiff card around 2mm thick and made of resin-impregnated paper or fibreglass. Holes are drilled to accept the wires and supporting legs of the various components. Winding their way between these holes are copper tracks which have been etched onto the surface, coated in tin solder to prevent them oxidising, and then covered in thin translucent plastic for protection.

Having had the components inserted, the whole assembly is dunked in a bath of molten solder to make the connections. No messing around with nasty soldering irons!

Designing a PCB is a nightmare, however, even with aid of the latest computer-assisted techniques. Although there are tracks on both sides, tracks on the same side cannot cross.

The science of PCB layout comes under the subject of topography. Topographers are distinguished by their ability to prove that a doughnut is identical to a coffee cup, and then an inner tube can *in theory* be turned inside out!

Interfaces

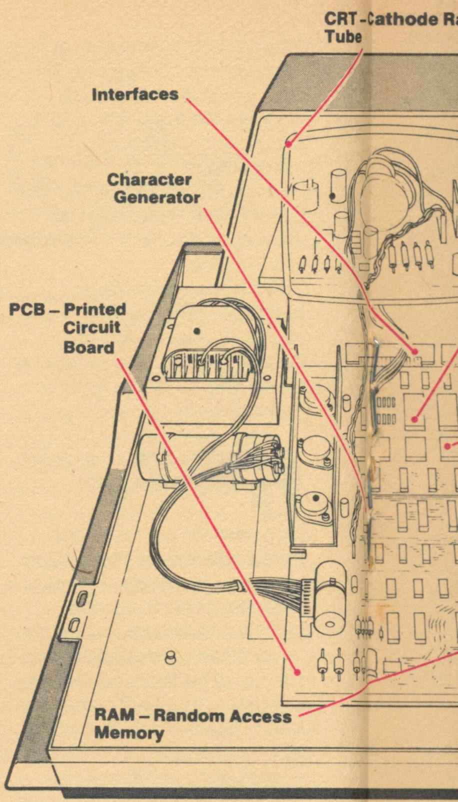
The *interfaces* are the means by which the computer communicates with external devices – such as a printer, floppy disk, or modem. The ones shown here are physically identifiable as *edge connectors* protruding from the back of the PCB – through they might equally well be lines of pins, jackplugs or hi-fi type sockets.

These days most interfaces are of a standard design – typically *IEEE488, RS232* and *S-100* – though sometimes specialist interfaces are incorporated for connection to non-standard devices.

RAM – Random Access Memory

This is the usable part of the computer's memory, where your programs, instructions and data are stored. *RAM* can be both read from and written to.

It is also the part of the PCB most susceptible to faults. RAM chips sometimes overheat, resulting in characters suddenly changing at random, usually followed by a system crash and the invocation of various deities. Regrettably, RAMs are not particulary cheap to replace.



ANATOMY OF A MICR

This one's a PET, though most of the compone

interface.

IEEE 488 Interface. Connects the OSBORNE 1 to the standard instrumentation bus, for data communication with test instruments.

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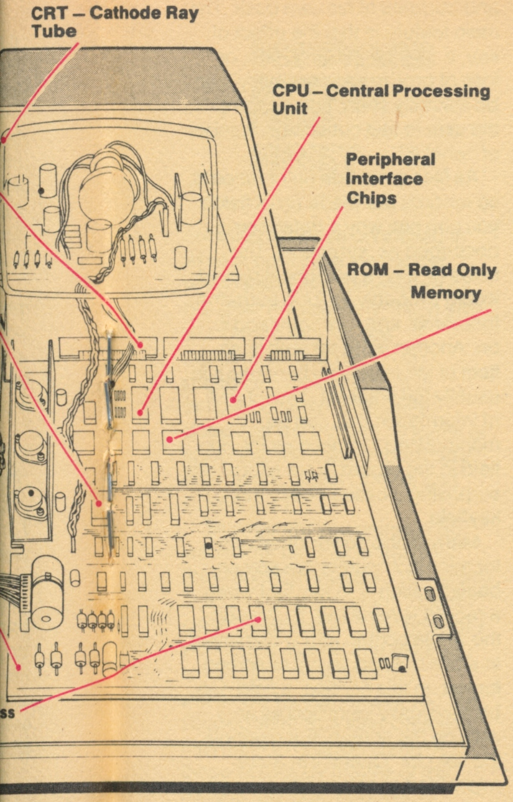

OF A MICROCOMPUTER

most of the components used are common to any micro.

Character Generator

The Character Generator is actually another ROM chip, but usually located away from the others. The electronic patterns of 1's and 0's encoded into this ROM, define the pattern of dots that make up each character on the computer's screen.

By replacing the standard character generator ROM with a custom-designed version, the character set can be changed to include foreign alphabets or special symbols.

ROM – Read Only Memory

This is the part of the computer's memory that is permanently programmed by the manufacturer. Like the pages of a book, information can be read from them, but not altered. This is the difference between ROM and RAM memory.

The *ROM* contains all the standard pieces of program code necessary for the computer to function. These include the *BASIC Interpreter* (assuming the machine runs in BASIC) and the *Operating System* needed to manage the parts of the system.

ROM is identified as a row of medium-to-large sized chips. Sometimes the row will have a number of empty sockets into which additional ROMs may be plugged.

Assuming you have the appropriate equipment, it is possible to customise your microcomputer so that programs you use all the time are permanently available in the machine from power-on.

Peripheral Interface Chips

These are variously known as PIC's, PIO's, PIA's or VIA's – all minor variations on the same terminology – and are the other large chips on the PCB. The CPU uses these devices to communicate with other units – both external peripherals and internal devices such as the screen, keyboard and built-in cassette, if present.

A PIC will generally accept a byte of information from the CPU and handle all the aspects of presenting that information to the interface bus, thereby freeing the CPU from unnecessarily trivial tasks. These tasks might include converting the bits from parallel to serial form, delaying for a specific number of microseconds, or arranging to toggle some external lines in the correct order; this is called a handshake.

Probably the most sophisticated and popular VIA (Versatile Interface Adaptor) is the MOS6522, used in the PET, and most other microcomputers for that matter.

CPU – Central Processing Unit

This is the very heart of the computer, the nerve centre of operations; it is called a microprocessor. On the Apple, PET and Atari systems, the particular brand of microprocessor is the MOS Technology 6502. Other popular units are the Zilog Z80 (used by Tandy and Sinclair), Intel 8080 and Motorola 6800. Last issue, we explained the role of the CPU (performing calculations and shuffling information around the different parts of its memory) in the *Compleat Computer Crib Sheet*.

The CPU is usually identifiable as the largest (or, as in this diagram, one of the largest) chips on the PCB. It will usually have some 40-pins: those are the little metal legs through which the signals pass to other devices.

A chip is more properly referred

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SOFTWARE BUYERS CRIB SHEET

The first problem in attempting to decipher the software salesman's jargon is that so much of it is ill-defined. For example, one company offers you a **program** to do your accounts, while the next one calls it a **package** – which is right?

Since the product will contain both a program (usually recorded on one or more diskettes) and **documentation** – which might mean anything from a few photocopied sheets to a professionally typeset handbook – 'package' is more appropriate.

The other term used is a **suite**; this is applicable when more than one distinct program can be loaded from the diskettes. There are two possible reasons for this: firstly, where a single program would simply be too large to fit in the memory of the computer. In this case, a technique called **chaining** is used. Part One is loaded and run. The memory is then cleared (but the data preserved), and replaced with Part Two for the program to continue.

Alternatively, the application may have several distinct functions which are best implemented as separate programs. For example, in an accounting suite you might have both Accounts Receivable and Accounts Payable. Where such programs pass information from one to the other, or merely share common sets of data, they are often described as an **integrated system.** A good example is Invoicing which may be integrated with a Stock Control program to update the amount of free stock every time an invoice is raised.

When running such a system, the first thing you will be presented with is a **menu** on the screen. As with the restaurant equivalent, this is simply a list of the options which can be selected by pressing a key – typically in the range 0 to 9.

The same process can be extended to the running of the program, so that at each stage you are presented with a list of possible actions – selected by a single key stroke. Such programs are **menu driven.**

Let's look now at the main types of business package. Most of the ones mentioned so far come under the heading **transaction processing** – because they related directly to some specific business transaction or document, such as an invoice or stock card.

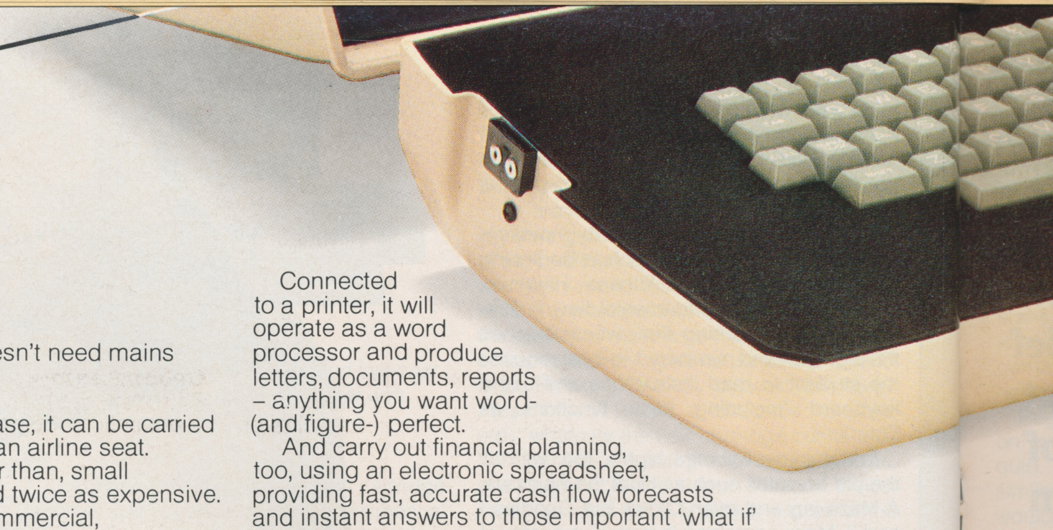
Probably the most popular single microcomputer application is **word processing**, which we covered in a special report in the July issue. Broadly speaking this encompasses all forms of typing, from memos and invoices, through to personalised mailshots. Text is entered and amended on the computer's VDU screen, optionally stored on floppy disk for later recall, and then printed out any number of times on a typewriter-quality printer.

A comparatively new type of software for microcomputers deals largely with calculations rather than the storage and processing of documents, and has been dubbed **Managerial Computing**. Programs like *VisiCalc* and *MicroModeller* provide the manager with a means of calculating forecasts and budgets at his own desk. The main feature is that the effect of, say, a change in Bank Rate, or loss of production capability, can be instantly seen, encouraging the user to test out a large number of "what if?"

As files are made up of records, so records are made up of **fields**; you can see why a database is described as 'structural'. The fields of, say, a personnel record would probably include surname, forename, age, tax code and so on. Another word for field is an **item** of information – because it is usually the smallest distinct unit of information that can be manipulated. Sometimes the first field in the record is not altogether surprisingly called called the **keyfield.**

Many of the newer databases for microcomputers are **screen-based**, which is to say that when a record is retrieved, it takes up the whole screen and is displayed in a pre-defined layout or **screen format.** In this context, a field can be physically identified as an area on the screen. For example, the field for 'Quantity in Stock' might start in column 20 of line 4 and consist of up to 12 characters in the range A to Z, 0 to 9.

These definitions, layouts and



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constraints are all contained in what is called the **file header**, which also lurks somewhere on the disk. (Incidentally, if you are wondering why we are concentrating so much on database applications, it is simply because, ultimately, database will replace all forms of specialist transaction programs like Payroll, Stock Control and Accounting.)

So what are you going to do with these records? First of all they must be entered – physically typed – into the system. This is called **Inserting** and the program will have a routine that asks you to fill in all the fields of the particular type of record you are dealing with. At a later date you may wish to change some of those details by means of the **Amend** function, or even completely **Delete** a record that is either erroneous or no longer required. In a real business application, the program will constantly be performing such operations, in other words **updating** the file, without your having to go through the whole process by hand each time.

Retrieving the records can be done using a variety of methods. Instead of having to remember the key or record number, you might request a **search**. This gets you almost instant answers to such diverse questions as "What was the name of that company which sold dishwashers?" or "How many of our coronary patients have also suffered from migraines?" The program will work through all the records, comparing the contents of the fields with your **search criteria** until it finds one or more that match.

Another common requirement is to **sort** a whole file into some kind of order. This might be alphabetical order of surname, numerical order of price, or chronological order of debts outstanding. Alternatively, you may wish to sort only a part of the file or just certain records. Sorting a file will generally mean faster access, and easier-to-understand printouts when you come to list the contents.

Most modern information systems now have a **mathematics facility** which enables simple arithmetic to be performed between fields in different records. You might, for example, specify: "Find any credit notes to the ABC company, accumulate their value, and subtract the result from their latest invoice."

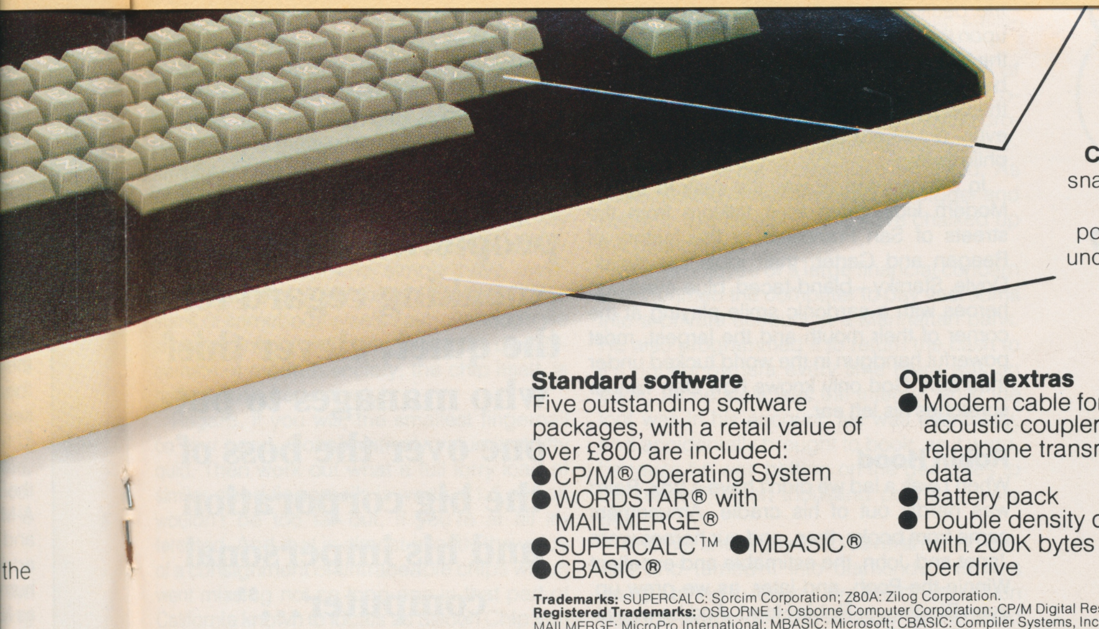
Ironically, although a computer filing system is supposed to render office paperwork obsolete, a printed sheet of paper is almost invariably the final product of a transaction on a business program. This could be anything from an invoice, or a stocklist summary, to a business letter, or set of self-adhesive mailshot labels. The package will have a specific facility to deal with printed output. In its simplest form, it is called a **Print Formatter**, since it permits the contents of a record to be printed in a particular format or layout. It may also include such features as underlining and boxes, as well as the ability to align columns of figures.

Slightly more sophisticated is the **text editor** or **document editor**, since it is better equipped to handle straight text such as for letters and contracts. In fact it is really a form of mini Word Processor and can be used to produce standard letters with the names and addresses drawn from the files stored on disk.

Most desirable of all, however, is a **Report Generator**, which *Inside Trader* claims is a substitute for middle-management, since all it does is generate reports all day long! The Report Generator does this by scanning through the various fields, summarising and consolidating the information you request, and then listing the results in the form of a report or list.

If you are buying a business package it is worth asking whether it has **password protection** to prevent unauthorised people from accessing your information. We are also pretty keen on **data security**, which really boils down to how well files are protected against power failure and the ability to 'backtrack' if your database becomes corrupted.

We welcome letters about readers' own experiences with business packages. Write to us at P.O. Box 2, Goring, Reading RG8 9LN.



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Keyboard – some units had proper typewriter-like keyboards, while others had solid touch-sensitive devices. We considered the 'feel' of the keys (important to the typist), the layout of the various functions – as well as clarity of the legend on the keytops. Computers with 'user-function keys' received additional marks.

Screen – this refers to the way characters and words are portrayed on the screen. Marks were awarded for large characters and crisp definition, and the ability to display both upper and lower case letters, as well as normal (white on black) and reverse (black on white) fields. Screens with a large number of columns (40 to 80) rated better than those with a limited number.

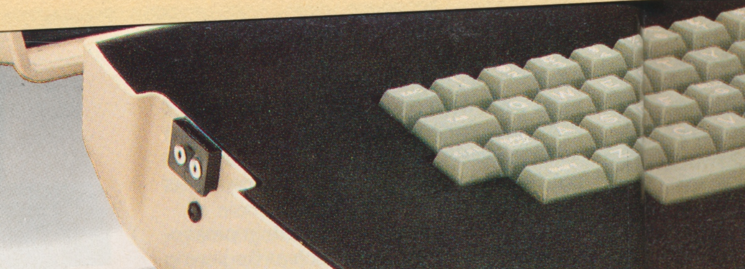
Colour/graphics – these two were lumped together since with the exception of Sinclair and Atom, all systems supported colour. We considered the clarity and usefulness of the graphic shapes as well as veracity and variety of colour. Most units offered a variety of colour/graphics *modes* in which as the *resolution* of the screen increased, the number of usable colours decreased.

Sound – some computers had a built-in speaker, while others made use of the one in the T.V. set. Scores were given to indicate both the range of sound effects possible and their tonal quality. Units with more than one tone generator could produce much better music, while a 'white noise generator' was useful for game sounds such as lasers, bombs and crashes.

Editing – this is one of the functions of a computer's *operating system*, and is used when writing programs to make alterations and corrections to lines of instructions. Being able to move the *cursor* to any point in the program and make a correction is obviously preferable to having to retype a whole line or more.

BASIC – in theory, BASIC is a standard language, specifically designed to be easy to learn. In practice, it varies considerably in both its constructs and its capabilities. The most common dialect is Microsoft BASIC and marks were given according to compatibility with this. Marks were also given for specific high-level commands for handling sound and colour.

	Sinclair ZX81	VIC-20	Atari 400	BBC A	BBC B	Atom (2K)	TRS-80 Colour	TI 99/4A
Construction	■	□	🟥	□	□	◩	◪	🟥
Keyboard	■	◪	◩	□	□	□	◪	🟥
Screen	◩	◩	◪	◪	🟥	◩	□	□
Colour/graphics	■	□	🟥	◪	🟥	◩	□	◪
Sound	–	◪	🟥	◪	◪	◩	◩	🟥
Editing	■	◪	◪	□	□	◩	◪	◪
BASIC	□	◪	🟥	◪	◪	◩	◪	□



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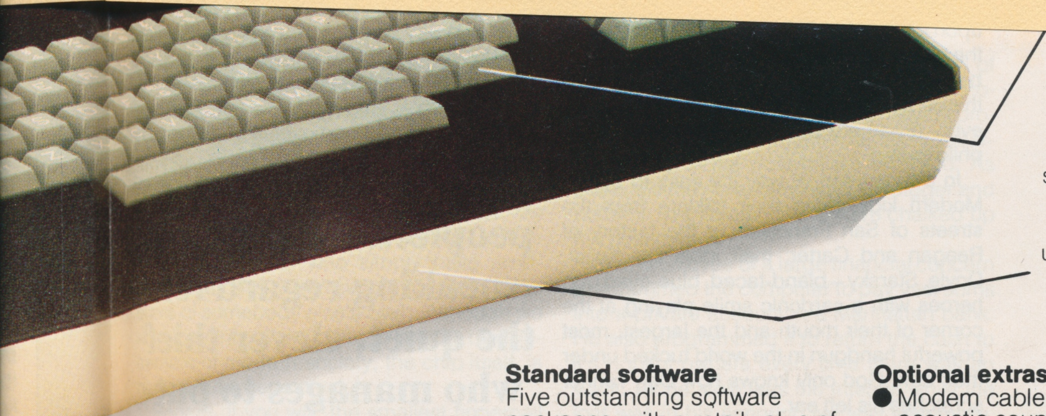
Poor ←——→ **Excellent**

	Sinclair ZX81	VIC-20	Atari 400	BBC A	BBC B	Atom (2K)	TRS-80 Colour	TI 99/4A
Memory – here we are referring to RAM or useable memory. Because some of the figures bandied about are confusing, our rating was based on the largest BASIC program that could be fitted into the unexpanded machine. Note that on most machines the colour graphics mode consumes a large portion of the memory.	■	◪	▨	▨	🟥	■	▨	▨
Plug-in packs – several machines had facilities to plug in additional memory, or sophisticated programs without the need for cassette or technical know-how! Those which accepted more than one pack at once scored highest. Also taken into consideration was the number and variety of packs available.	–	□	🟥	■	■	–	▨	🟥
Expansion – a computer that can easily be expanded or enhanced is one that is less likely to become obsolete. This includes expanding the memory and display-colour options, as well as peripherals, such as floppy disk or printer. We looked at each computer's *expansion ports* and their possible uses, as well as the range of compatible products from the computer manufacturer and independent suppliers.	◪	▨	□	▨	🟥	□	□	□
Game controls – though this is one form of expansion, we have treated game controls such as joysticks, paddles and light pens separately. The number and variety of attachable devices was important – along with the quality and pricing of the units available.	–	□	🟥	▨	▨	–	□	□
Cassette – all systems could record and reload programs onto cassette tape. Where we've allocated an above average score, this indicates that almost any domestic cassette recorder can be used (though to make absolutely sure, check with the manufacturer). Otherwise the manufacturer's specific unit must be purchased at additional cost. Variations in mark are based on the speed at which programs are loaded.	□	◪	◪	🟥	🟥	▨	◪	🟥
Software – difficult to quantify, but we've tried to give a rating for the variety of software products (from games, through learning systems, to the dreaded household accounts) that can be purchased for each machine on cassette or ROM pack. Because several of the contestants are new animals, we have also taken into account compatibility with other machines and the number of independent suppliers currently developing software.	◪	□	▨	◪	◪	◪	▨	▨
Documentation – until recently the weakest part of a computer systemwas always the instruction manual. Here we've based the rating as far as possible on user's comments. Positive marks for good layout, illustration and clarity of explanation. Negative ones for errors, lack of summary table and generally being too technical for an absolute beginner.	□	□	🟥	not	known	□	▨	🟥
Price – not much to say here except that in every case we have given the price for the computer in its simplest configuration including VAT. Power supply is included, but not the cassette recorder.	70	190	345	235	335	175	449	299



Case. The plastic case snaps together to form a weatherproof, 24-pound package that fits underneath the standard airline seat.

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Optional extras
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- Battery pack
- Double density disk drives with 200K bytes of storage per drive

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HOW TO CHOOSE?

Do you intend to learn to program?

This is by far the most popular reason for buying a microcomputer – but your computer needs are rather different than for someone who just wants it to run games and other off-the-shelf programs. **BASIC** will almost certainly be the first programming language you will learn, so the more standard the version of BASIC on a computer, the better it is for learning.

Perhaps next most important is the quality of **documentation** supplied with the machine (though many manufacturers will sell separate BASIC learning courses in either cassette or book form). Use our rating as a guide, but make your own test in the shop. Does the manual look well written? Does it appear to be printed in a foreign language? Are there helpful hints and diagrams – or does the whole thing look so technical that you will probably have to give up by page 3? Are there any naked ladies on page 3?

The **keyboard** is important when you are typing in programs, as is the **editing** for making alterations and later program enhancements. Though you will never be able to key in a line of BASIC as fast as a sentence of English, it is important that you are happy with the 'feel' of the keys and can locate all the functions without unnecessary 'hunting'.

The width of the **display** will determine the ease with which you can read your program listings. 80 columns is best, because BASIC allows line lengths of up to 80 characters, but often not practical – so most computers have to display the lines broken into two, three or four parts.

The more **memory** you have, the larger (and hence more useful) the programs you can write – but for simply learning the mechanics of programming you only need the minimum.

Are games important?

These days, high-quality video games and other entertainment packages offer a perfectly good justification for purchasing a home microcomputer. After all, the price compares very favourably with the more sophisticated dedicated T.V. games – and you can always teach yourself to program! Even if you are buying a microcomputer for more 'serious' reasons – can you really resist the lure of some of the latest games?

Colour and **sound** are obviously what make good arcade games come alive – so look out for a high score in these departments. **Game controls** you will find much easier to use than pressing keys to navigate your way around the Galaxy, dungeon or Dodge City.

Lastingly satisfactory – games programs are almost impossible to write unless you are an expert programmer so you will be relying on the commercial **software** available. Take a good look at the range of titles on sale locally.

If the games are in the form of **plug-in packs**, the fact that they are in ROM will mean they won't require a lot of RAM memory in which to run. However, ROM pack programs are more expensive than their cassette equivalent, and not all systems offer the plug-in facility.

If there is a strong likelihood that you will be buying games in cassette form, it is important that you go for a machine with lots of **memory**.

Is the computer to be used by young children?

If young children are to be the prime users of your home computer the first consideration should be physical **construction** (yours and the computers!) Quite apart from whether the case is sufficiently robust to weather the knocks and spills of family life, some units employ both an external power supply unit and separate T.V. modulator. Such a configuration can end up looking unsightly and leaves a large number of trailing wires to be tripped over.

Most of the features important to games will apply especially for young children: **colour, sound** and **game controls,** and you should also consider the **keyboard** carefully. In this respect, young children are *less* likely to be worried by a 'touch sensitive' keyboard, but *can* be put off by large arrays of poorly enscribed keys.

Plug-in packs are definitely a plus – not only because they are more robust than their cassette

IEEE 488 Interface. Connects the OSBORNE 1 to the standard instrumentation bus, for data communication with test instruments.

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Or even a desk of its own.
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It's – as you can see – portable.
Weighing under 24lb in its weatherproof case, it can be carried in one hand. Or in your car. Or tucked under an airline seat.
But its performance is equal to, often better than, small business computers several times as big and twice as expensive.
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HOW TO CHOOSE?

equivalent, but also because they eliminate the time delays associated with cassette loading. Waiting two or three minutes to change a program can seen an eternity to a child. However, you should satisfy yourself that the plug-in procedure is sufficiently trouble-free to be mastered by your children.

Will you want to expand the machine later?

Most people will answer 'yes' to this question because they realise that at some future stage they will need more memory; they may well also plan to replace their 200 accumulated cassette tapes with a single floppy disk.

A machine that is well-equipped for **expansion** will obviously last longer in terms of obsolescence. However, we should warn potential buyers that there can be a bit of a trap in expansion. Particularly with cheaper machines, there comes a point where it is more economical in the long-run to trade-in for a larger machine than to carry on adding more memory and facilities.

The other thing to watch out for is the **software** – will all your existing programs still run on an expanded computer and do they have options for printers and so forth?

Is budget a major consideration?

Alas for most of us this is the case, so you might conclude we are stating the obvious when we say you would do well to look at **price** first. There is very little point in asking which is the best computer for under £100 when there is only one.

Broadly speaking there are no hidden catches or bargains in the home computer market (although this is not true of the business systems market) so the more you pay, the better the computer's facilities. Where cash is short, it is worth looking at a machine with good **expansion** facilities so that you can upgrade in small, relatively painless stages.

Lastly, you should opt for a system that makes use of a domestic **cassette** recorder (assuming you have one) to save on future costs there.

◁

THE MOST ASKED QUESTIONS

salt should be able to quote you a maximum and typical search time – based on the amount of data you intend to store.

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ANATOMY OF A MICROCOMPUTER

to as an Integrated Circuit or I.C. and consists of a tiny 5mm square of semiconductor material, entirely encased in black plastic up to 2" in length. The editor of this magazine applies his blue pencil to all chip jokes. No one has yet submitted a PCB joke.

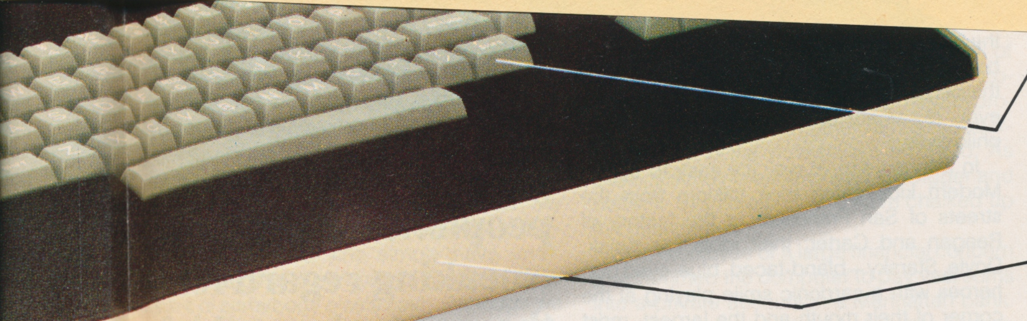
THE COMPLEAT COMPUTER CRIB SHEET

◁

also used when communicating with other computers, which is termed **Networking.**

The most common peripherals are listed below. A **Cassette** unit **Saves** programs and data from computer memory on cassette, so that they can be **Loaded** back again when required. A **Disk Drive** does the same, employing a circular piece of magnetic material called a **Floppy Diskette.** This has a higher storage capacity than cassette and allows faster access. See *"Do You Need 'Disk'?"* in this issue.

A **Printer** is used to create permanent copies of information on paper, and will usually offer either high speed or high print quality. The differences are explained in *'How to buy a Printer'* (August issue). Finally, a **Modem** is a small unit that converts electronic data into audio tones and back so that information can be sent over an ordinary telephone line.



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Optional extras
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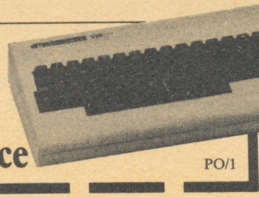

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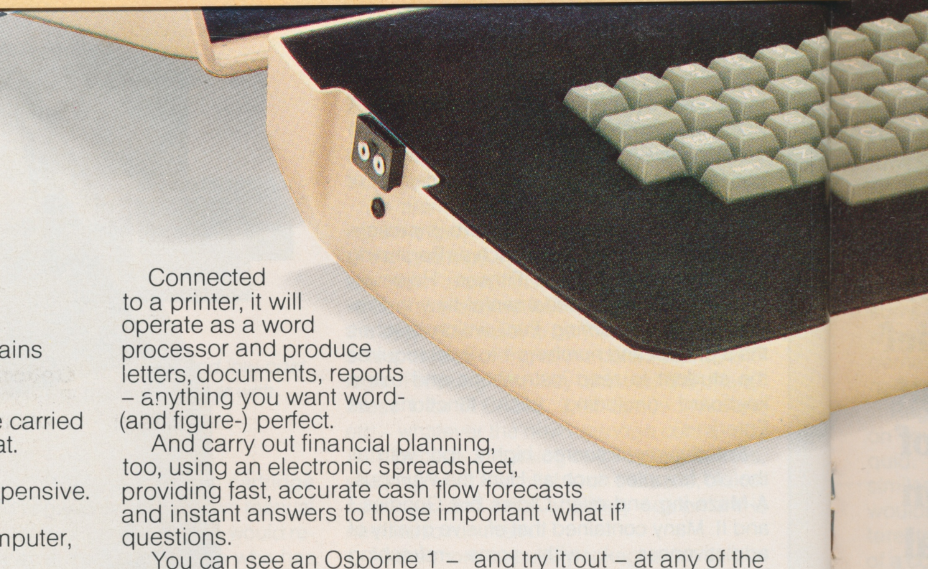

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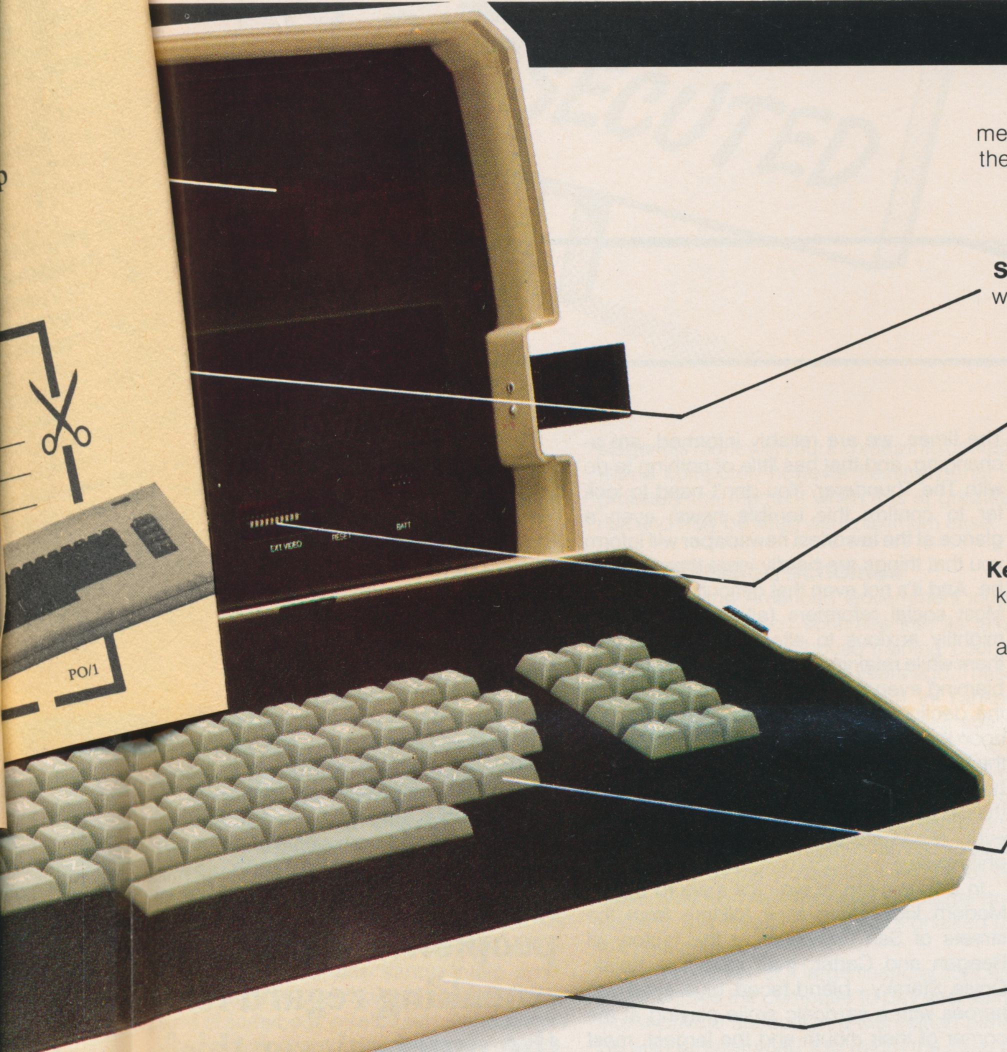


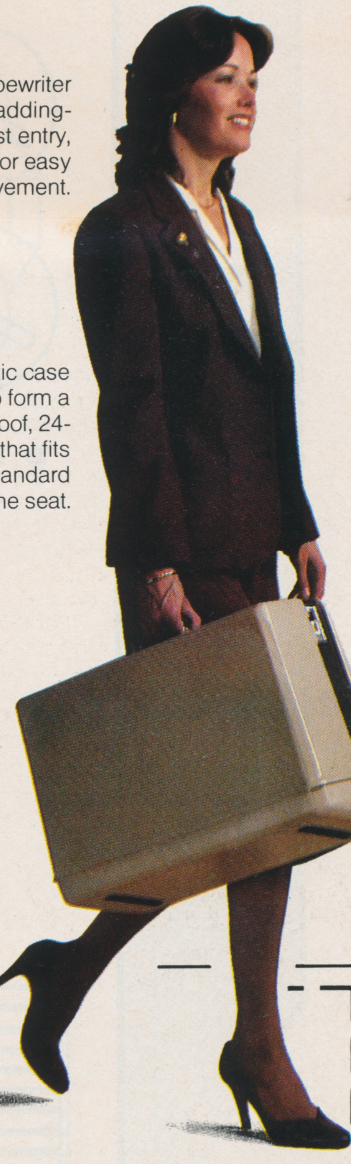
Internal electronics. Z80A™ CPU, 64K bytes RAM memory (60K available to the programmer, 4K used to run the screen.) System software is held in ROM in a separate address space.

Screen. Clear, 5", 24-row screen displays a 52-character window on a 128-character line with automatic horizontal scrolling.

Monitor Interface. Connects the OSBORNE 1 to any monitor screen.

Keyboard. A standard typewriter keyboard plus numeric, adding-machine keypad for fast entry, and cursor control keys for easy cursor movement.

Case. The plastic case snaps together to form a weatherproof, 24-pound package that fits underneath the standard airline seat.



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